



UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

Escola Tècnica Superior d'Enginyeries
Industrial i Aeronàutica de Terrassa

STUDY AND SIMULATION OF CUBESATS COMMUNICATION SYSTEMS FOR ISARA MISSION

ANNEX

STUDENT: JORDI COLL ORTEGA

DIRECTOR: IGNACIO GIL GALI

STUDIES: GRAU EN ENGINYERIA EN VEHICLES AEROESPACIALS

DELIVERY DATE: JUNE 22, 2016

TABLE OF CONTENTS

LIST OF FIGURES	ii
CONTENTS SUMMARY.....	1
A. SOFTWARE SIMULATIONS.....	2
A.1 Isolated UHF antenna	2
A.1.1 Monopole P1.....	2
A.1.2 Monopole P2.....	6
A.1.3 Turnstile: All Ports.....	10
A.2 3U UHF antenna.....	17
A.2.1 Monopole P1.....	17
A.2.2 Monopole P2.....	21
A.2.3 Dipole P1 & P3	25
A.2.4 Turnstile: All Ports.....	30
A.3 ISARA UHF antenna.....	38
A.3.1 Monopole P1.....	38
A.3.2 Monopole P2.....	42
A.3.3 Turnstile: All Ports.....	47
B. ISIS WEBSITE RADIATION PATTERNS.....	55
B.1 3U UHF Monopole.....	55
B.2 3U UHF Dipole.....	56
B.3 3U UHF Turnstile	57

LIST OF FIGURES

Figure 1. A1-P1. ISIS antenna CAD model.	2
Figure 2. A1-P1. Return loss.	2
Figure 3. A1-P1. 3D Directivity Pattern (414 MHz).....	3
Figure 4. A1-P1. Directivity Polar Diagram (414 MHz).	3
Figure 5. A1-P1. 3D Realized Gain Pattern (414 MHz).	4
Figure 6. A1-P1. Realized Gain dependent on range frequency 130-500 MHz.....	4
Figure 7. A1-P1. Antenna efficiency dependent on range frequency 130-500 MHz.	4
Figure 8. A1-P1. Electric field (414 MHz).....	5
Figure 9. A1-P1. Magnetic field (414 MHz).	5
Figure 10. A1-P2. ISIS antenna CAD model.	6
Figure 11. A1-P2. Return loss.	6
Figure 12. A1-P2. 3D Directivity Pattern (197 MHz).....	7
Figure 13. A1-P2. Directivity Polar Diagram (197 MHz).	7
Figure 14. A1-P2. 3D Realized Gain Pattern (197 MHz).	8
Figure 15. A1-P2. Realized Gain dependent on range frequency 130-500 MHz.....	8
Figure 16. A1-P2. Antenna efficiency dependent on range frequency 130-500 MHz.	8
Figure 17. A1-P2. Electric field (197 MHz).....	9
Figure 18. A1-P2. Magnetic field (197 MHz).	9
Figure 19. A1-Turnstile. ISIS antenna CAD model.	10
Figure 20. A1-Turnstile. Return loss.	10
Figure 21. A1-Turnstile. Insertion loss.....	10
Figure 22. A1-Turnstile. 3D Directivity Pattern (196 MHz).	11
Figure 23. A1-Turnstile. Directivity Polar Diagram (196 MHz).	11
Figure 24. A1-Turnstile. 3D Directivity Pattern (414 MHz).	12
Figure 25. A1-Turnstile. Directivity Polar Diagram (414 MHz).	12
Figure 26. A1-Turnstile. 3D Realized Gain Pattern (196 MHz).	13
Figure 27. A1-Turnstile. 3D Realized Gain Pattern (414 MHz).	13
Figure 28. A1-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P1 and P3.	14
Figure 29. A1-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P2 and P4.	14
Figure 30. A1-Turnstile. Antenna efficiency dependent on range frequency 130-500 MHz.	14
Figure 31. A1-Turnstile. Electric field (196 MHz).	15
Figure 32. A1-Turnstile. Electric field (414 MHz).	15
Figure 33. A1-Turnstile. Magnetic field (196 MHz).	16
Figure 34. A1-Turnstile. Magnetic field (414 MHz).	16
Figure 35. A2-P1. 3U UHF antenna CAD model.....	17
Figure 36. A2-P1. Return loss.	17
Figure 37. A2-P1. 3D Directivity Pattern (417 MHz).....	18
Figure 38. A2-P1. Directivity Polar Diagram (417 MHz).	18
Figure 39. A2-P1. 3D Realized Gain Pattern (417 MHz).	19
Figure 40. A2-P1. Realized Gain dependent on range frequency 130-500 MHz.....	19
Figure 41. A2-P1. Antenna efficiency dependent on range frequency 130-500 MHz.	19
Figure 42. A2-P1. Electric field (417 MHz).....	20
Figure 43. A2-P1. Magnetic field (417 MHz).	20

Figure 44. A2-P2. 3U UHF antenna CAD model.....	21
Figure 45. A2-P2. Return loss.	21
Figure 46. A2-P2. 3D Directivity Pattern (163 MHz).....	22
Figure 47. A2-P2. Directivity Polar Diagram (163 MHz).	22
Figure 48. A2-P2. 3D Realized Gain Pattern (163 MHz).	23
Figure 49. A2-P2. Realized Gain dependent on range frequency 130-500 MHz.....	23
Figure 50. A2-P2. Antenna efficiency dependent on range frequency 130-500 MHz.	24
Figure 51. A2-P2. Electric field (163 MHz).....	24
Figure 52. A2-P2. Magnetic field (163 MHz).	25
Figure 53. A2-Dipole. 3U UHF antenna CAD model.	25
Figure 54. A2-Dipole. Return loss and insertion loss.	26
Figure 55. A2-Dipole. 3D Directivity Pattern (416 MHz).	26
Figure 56. A2-Dipole. Directivity Polar Diagram (416 MHz).	27
Figure 57. A2-Dipole. 3D Realized Gain Pattern (416 MHz).	27
Figure 58. A2-Dipole. Realized Gain dependent on range frequency 130-500 MHz.	28
Figure 59. A2-Dipole. Antenna efficiency dependent on range frequency 130-500 MHz.	28
Figure 60. A2-Dipole. Electric field (416 MHz).	29
Figure 61. A2-Dipole. Magnetic field (416 MHz).	29
Figure 62. A2-Turnstile. 3U UHF antenna CAD model.	30
Figure 63. A2-Turnstile. Return loss.	30
Figure 64. A2-Turnstile. Insertion loss.....	31
Figure 65. A2-Turnstile. 3D Directivity Pattern (161 MHz).	31
Figure 66. A2-Turnstile. Directivity Polar Diagram (161 MHz).	32
Figure 67. A2-Turnstile. 3D Directivity Pattern (415 MHz).	32
Figure 68. A2-Turnstile. Directivity Polar Diagram (415 MHz).	33
Figure 69. A2-Turnstile. 3D Realized Gain Pattern (161 MHz).	33
Figure 70. A2-Turnstile. 3D Realized Gain Pattern (415 MHz).	34
Figure 71. A2-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P1 and P3.	34
Figure 72. A2-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P2 and P4.	35
Figure 73. A2-Turnstile. Antenna efficiency dependent on range frequency 130-500 MHz.	35
Figure 74. A2-Turnstile. Electric field (161 MHz).	36
Figure 75. A2-Turnstile. Electric field (415 MHz).	36
Figure 76. A2-Turnstile. Magnetic field (161 MHz).	37
Figure 77. A2-Turnstile. Magnetic field (415 MHz).	37
Figure 78. A3-P1. ISARA UHF antenna CAD model.....	38
Figure 79. A3-P1.Return loss.	38
Figure 80. A3-P1. 3D Directivity Pattern (418 MHz).....	39
Figure 81. A3-P1. Directivity Polar Diagram (418 MHz).	39
Figure 82. A3-P1. 3D Realized Gain Pattern (418 MHz).	40
Figure 83. A3-P1.Realized Gain dependent on range frequency 130-500 MHz.	40
Figure 84. A3-P1. Antenna efficiency dependent on range frequency 130-500 MHz.	41
Figure 85. A3-P1. Electric field (418 MHz).....	41
Figure 86. A3-P1. Magnetic field (418 MHz).	42
Figure 87. A3-P2. ISARA UHF antenna CAD model.....	42
Figure 88. A3-P2. Return loss.	43
Figure 89. A3-P2. 3D Directivity Pattern (159 MHz).....	43

Figure 90. A3-P2. Directivity Polar Diagram (159 MHz).	44
Figure 91. A3-P2. 3D Realized Gain Pattern (159 MHz).	44
Figure 92. A3-P2. Realized Gain dependent on range frequency 130-500 MHz.....	45
Figure 93. A3-P2. Antenna efficiency dependent on range frequency 130-500 MHz.	45
Figure 94. A3-P2. Electric field (159 MHz).....	46
Figure 95. A3-P2. Magnetic field (159 MHz).	46
Figure 96. A3-Turnstile. ISARA UHF antenna CAD model.	47
Figure 97. A3-Turnstile. Return loss.	47
Figure 98. A3-Turnstile. Insertion loss.....	48
Figure 99. A3-Turnstile. 3D Directivity Radiation Pattern (154 MHz).	48
Figure 100. A3-Turnstile. Directivity Polar Diagram (154 MHz).	49
Figure 101. A3-Turnstile. 3D Directivity Pattern (416 MHz).	49
Figure 102. A3-Turnstile. Directivity Polar Diagram (416 MHz).	50
Figure 103. A3-Turnstile. 3D Realized Gain Pattern (154 MHz).	50
Figure 104. A3-Turnstile. 3D Realized Gain Pattern (416 MHz).	51
Figure 105. A3-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P1 and P3.....	51
Figure 106. A3-Turnstile. Realized Gain dependent on range frequency 130-500 MHz.P2 and P4.....	51
Figure 107. A3-Turnstile. Antenna efficiency dependent on range frequency 130-500 MHz. ...	52
Figure 108. A3-Turnstile. Electric field (154 MHz).	52
Figure 109. A3-Turnstile. Electric field (416 MHz).	53
Figure 110. A3-Turnstile. Magnetic field (154 MHz).	53
Figure 111. A3-Turnstile. Magnetic field (416 MHz).	54
Figure 112. B1. 3D Gain Pattern.....	55
Figure 113. B1. Gain Polar Diagram.	55
Figure 114. B2. 3D Gain Pattern.....	56
Figure 115. B2. Gain Polar Diagram.	56
Figure 116. B3. 3D Gain Pattern.....	57
Figure 117. B3. Gain Polar Diagram.	57

CONTENTS SUMMARY

This document works as a complement to the explanations of CHAPTER 4 from the REPORT of this study. It is exclusively illustrative and contains all the graphics and images necessities to understand the performance of the ISIS UHF antenna during its operation in ISARA mission.

It is divided in two main sections:

- A. SOFTWARE SIMULATIONS
- B. ISIS WEBSITE RADIATION PATTERNS

In section A, it can be found all the results of the CST Microwave Studio simulations. It has been studied 3 main configuration cases:

- 1. Isolated UHF antenna
- 2. 3U UHF antenna
- 3. ISARA UHF antenna

The antenna studied is made up by four monopoles of two different longitudes. For this reason, for each configuration case it has been studied every monopole separately and, finally, all together. As they are sized in twos, it was just required to simulate two of them ($P1 = P3$ and $P2 = P4$). Totally, it has been made 10 different simulations. The obtained graphics in each simulation are:

- a) S – Parameters
 - Return loss
 - Insertion loss (if needed)
- b) Radiation Pattern
 - 3D Directivity pattern
 - Directivity polar diagram
 - 3D Realized Gain
 - Gain vs frequency range
- c) Efficiency vs frequency range
- d) Electric field
- e) Magnetic field

On the other hand, in section B, it is showed the radiation patterns facilitated by *Innovative Solutions In Space* Company on their website, as useful information about the UHF antenna performance. There were only for 3U UHF configuration with monopole, dipole and turnstile cases.

A. SOFTWARE SIMULATIONS

A.1 Isolated UHF antenna

A.1.1 Monopole P1

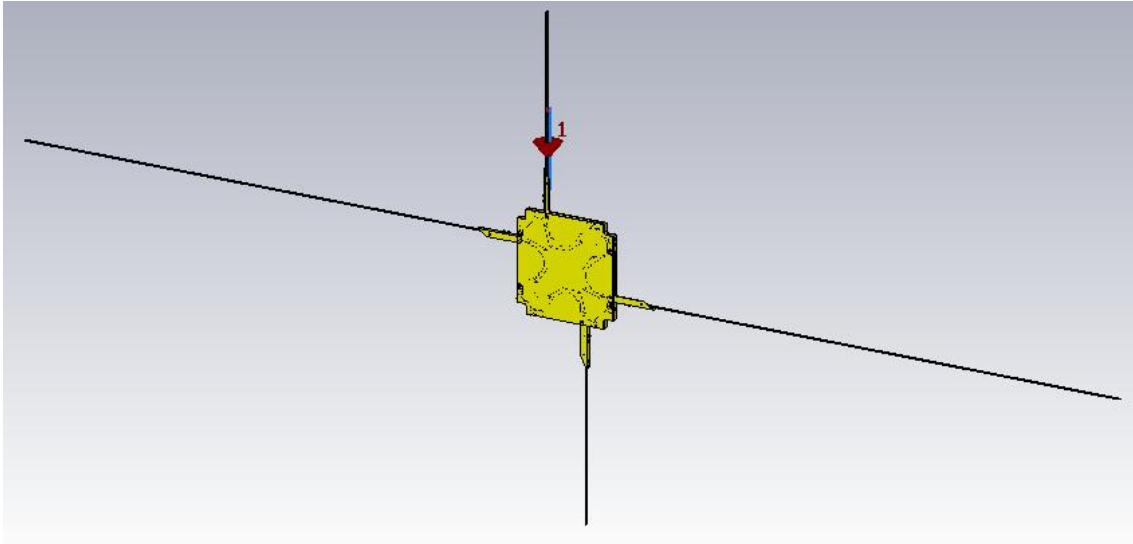


Figure 1. A1-P1. ISIS antenna CAD model.

A.1.1.1 Scattering Parameters (*S* – Parameters)

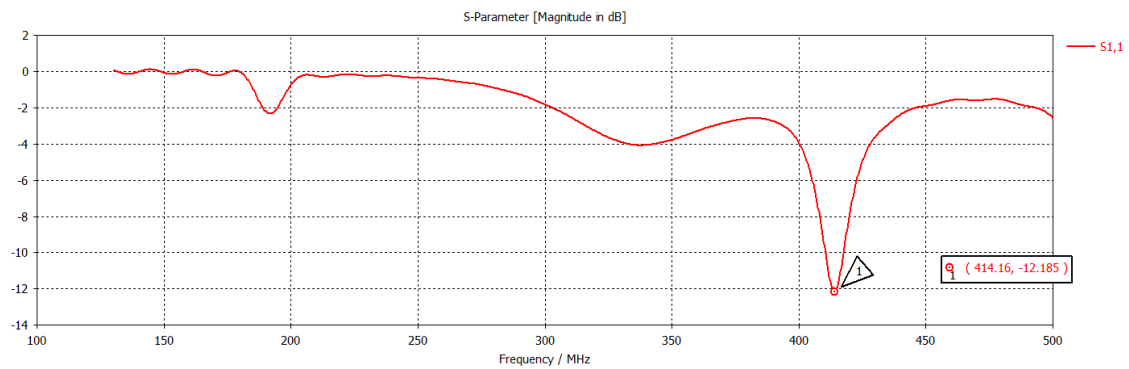


Figure 2. A1-P1. Return loss.

A.1.1.2 Radiation Pattern

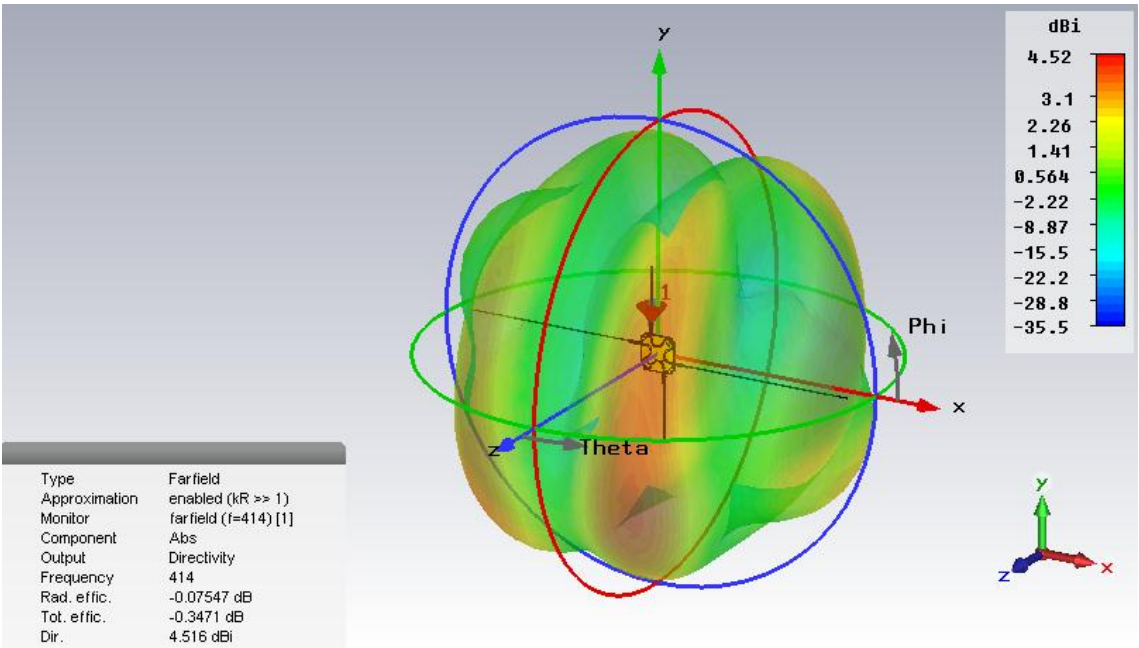


Figure 3. A1-P1. 3D Directivity Pattern (414 MHz).

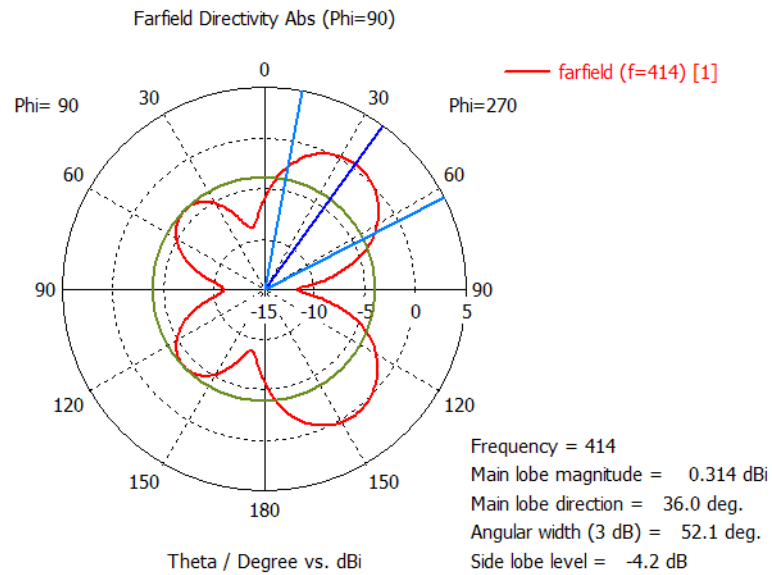


Figure 4. A1-P1. Directivity Polar Diagram (414 MHz).

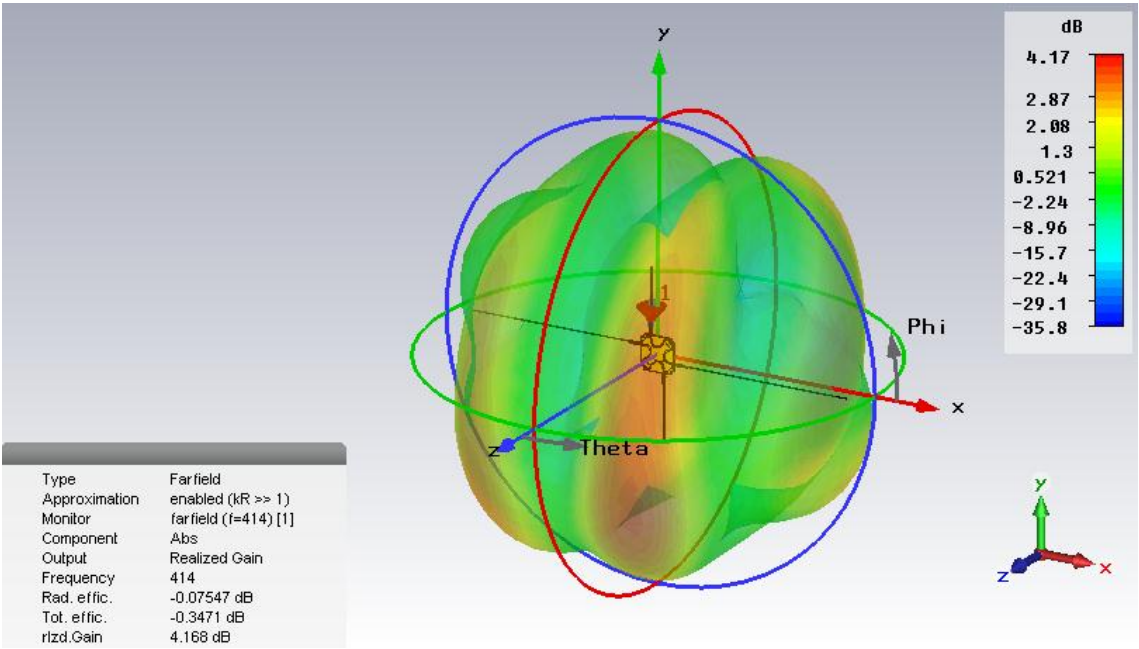


Figure 5. A1-P1. 3D Realized Gain Pattern (414 MHz).

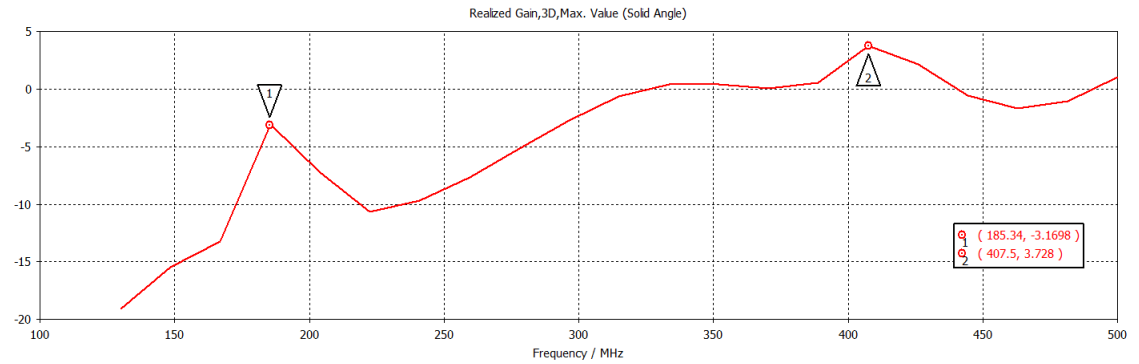


Figure 6. A1-P1. Realized Gain dependent on range frequency 130-500 MHz.

A.1.1.3 Efficiency

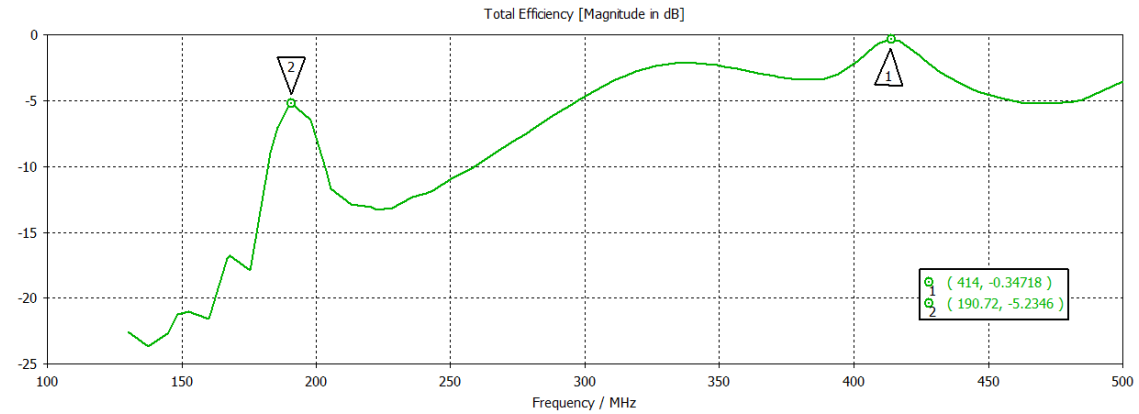


Figure 7. A1-P1. Antenna efficiency dependent on range frequency 130-500 MHz.

A.1.1.4 Electric field

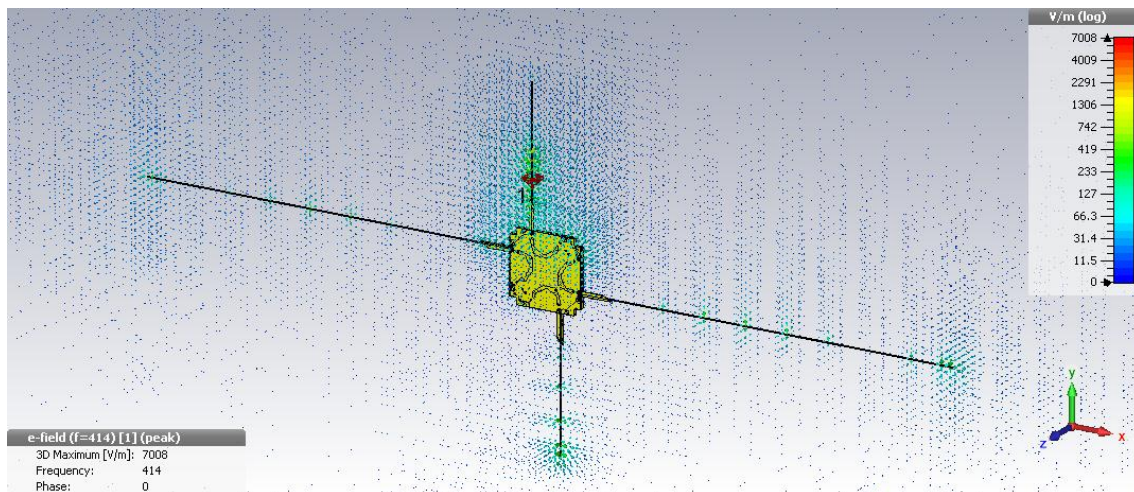


Figure 8. A1-P1. Electric field (414 MHz).

A.1.1.5 Magnetic field

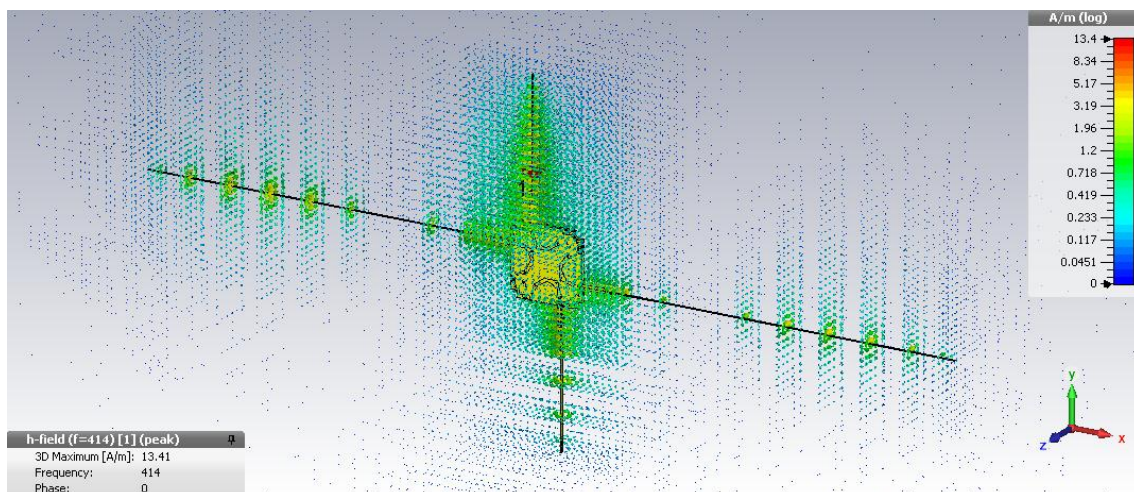


Figure 9. A1-P1. Magnetic field (414 MHz).

A.1.2 Monopole P2

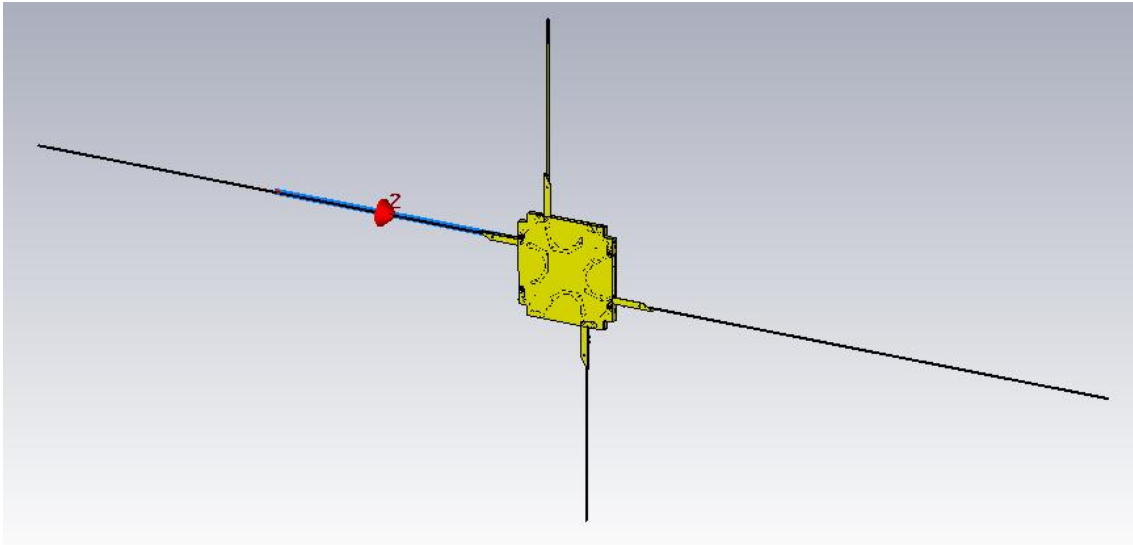


Figure 10. A1-P2. ISIS antenna CAD model.

A.1.2.1 Scattering Parameters (S – Parameters)

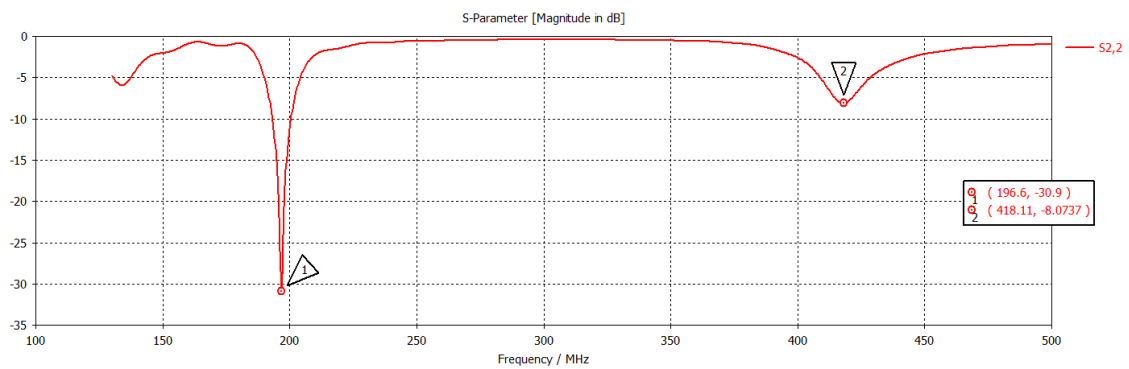


Figure 11. A1-P2. Return loss.

A.1.2.2 Radiation Pattern

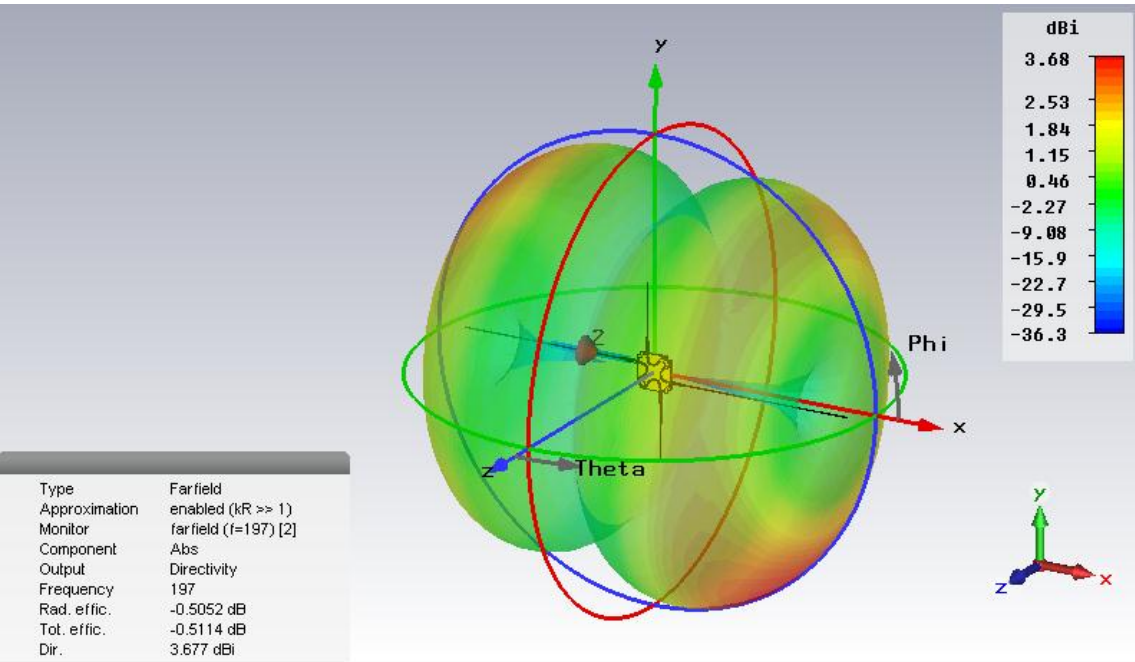


Figure 12. A1-P2. 3D Directivity Pattern (197 MHz).

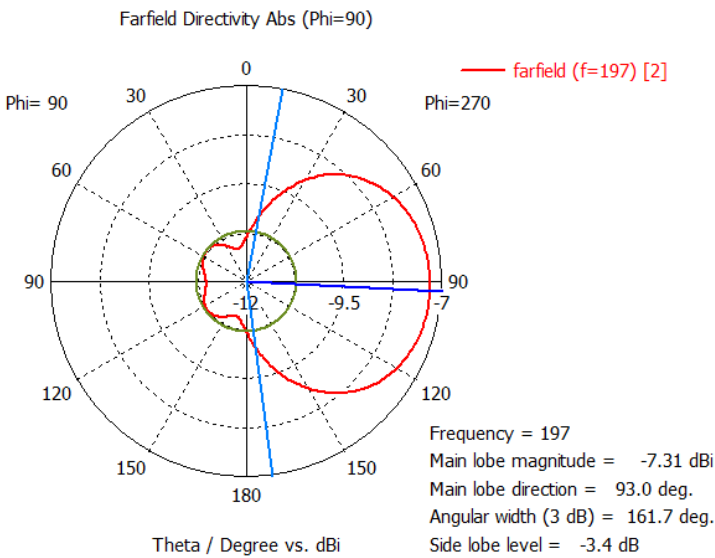


Figure 13. A1-P2. Directivity Polar Diagram (197 MHz).

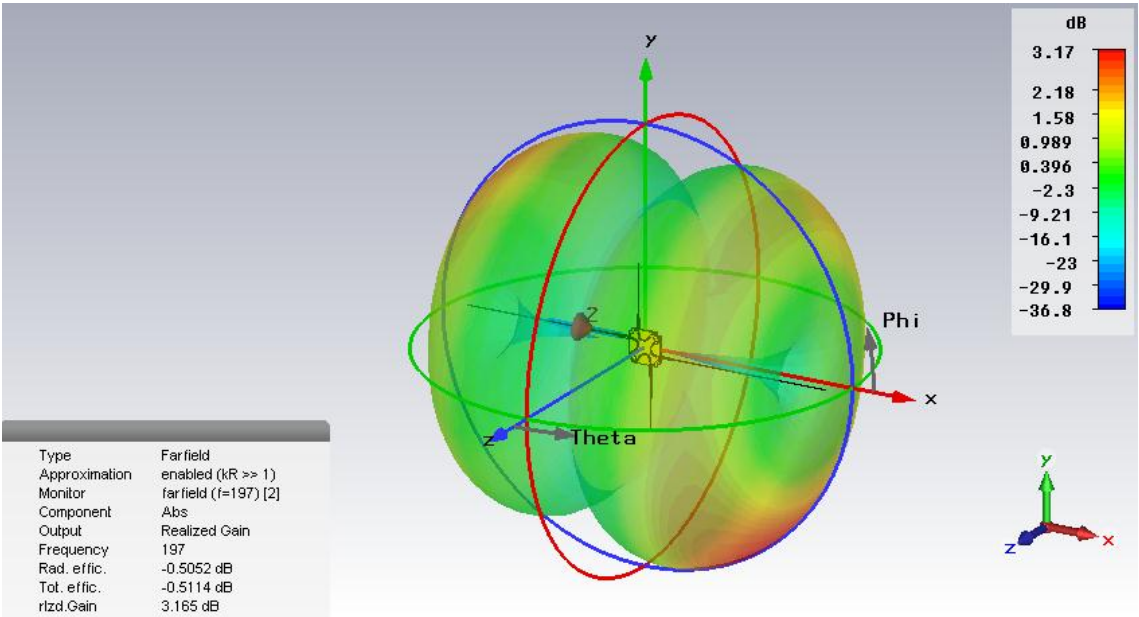


Figure 14. A1-P2. 3D Realized Gain Pattern (197 MHz).

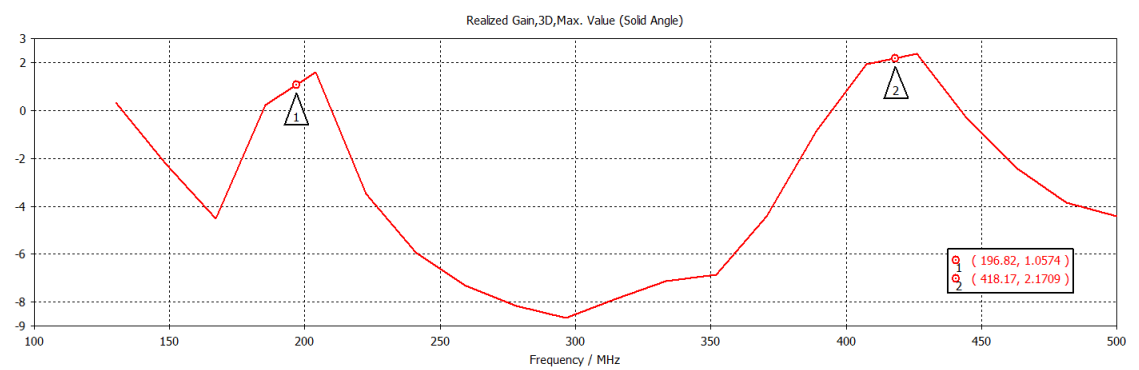


Figure 15. A1-P2. Realized Gain dependent on range frequency 130-500 MHz.

A.1.2.3 Efficiency

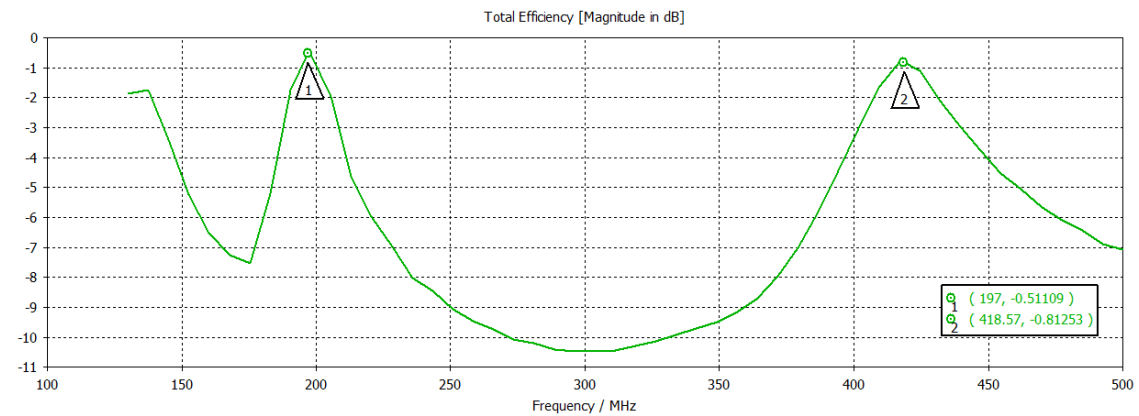


Figure 16. A1-P2. Antenna efficiency dependent on range frequency 130-500 MHz.

A.1.2.4 Electric field

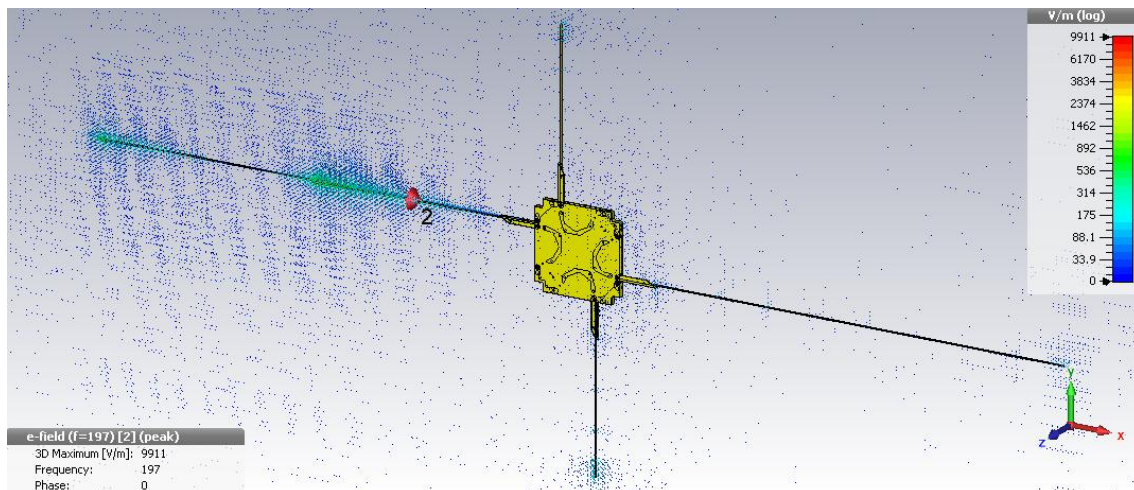


Figure 17. A1-P2. Electric field (197 MHz).

A.1.2.5 Magnetic field

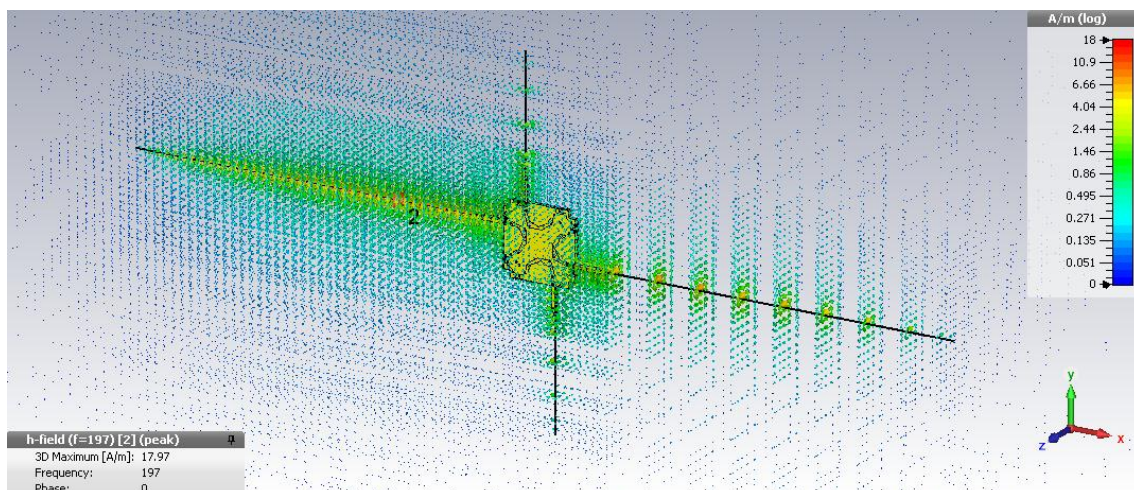


Figure 18. A1-P2. Magnetic field (197 MHz).

A.1.3 Turnstile: All Ports

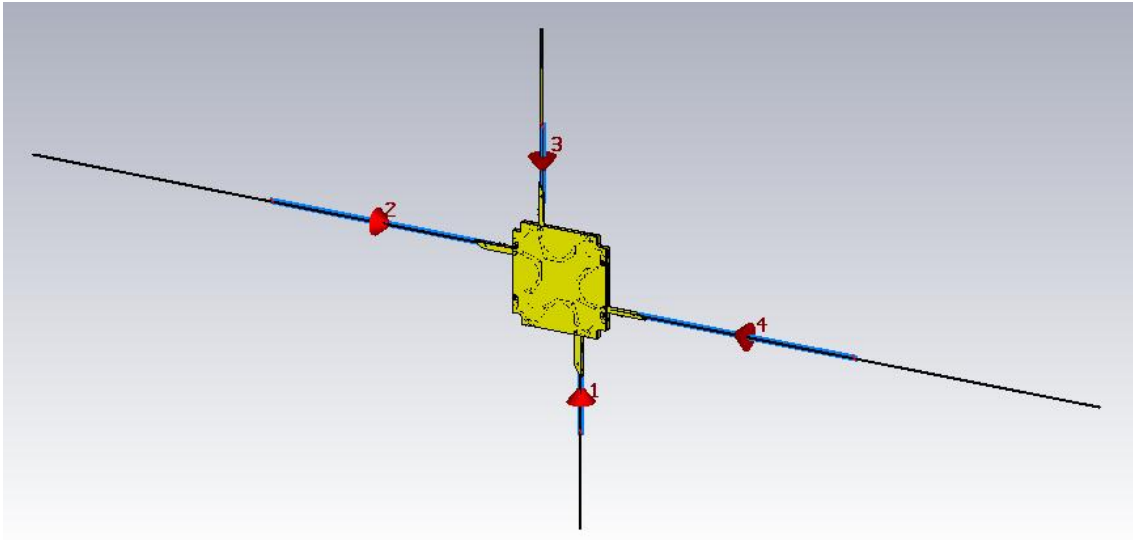


Figure 19. A1-Turnstile. ISIS antenna CAD model.

A.1.3.1 Scattering Parameters (S – Parameters)

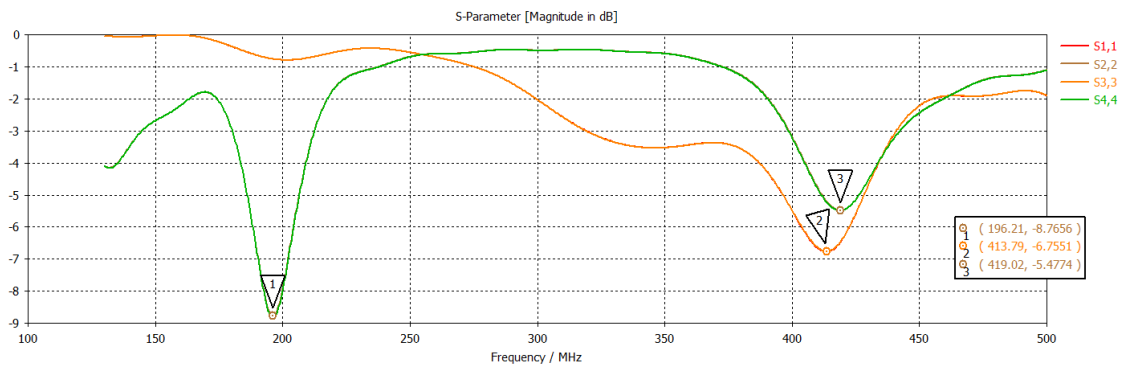


Figure 20. A1-Turnstile. Return loss.

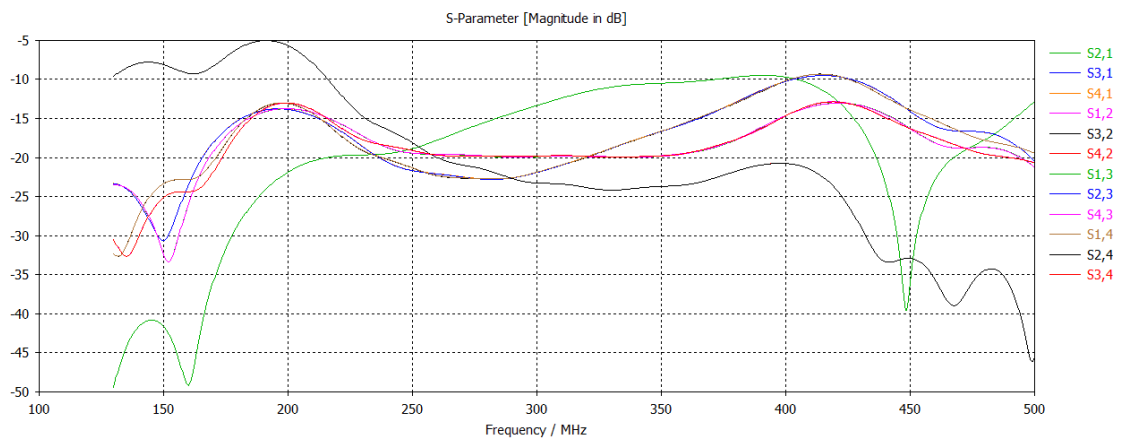


Figure 21. A1-Turnstile. Insertion loss.

A.1.3.2 Radiation Pattern

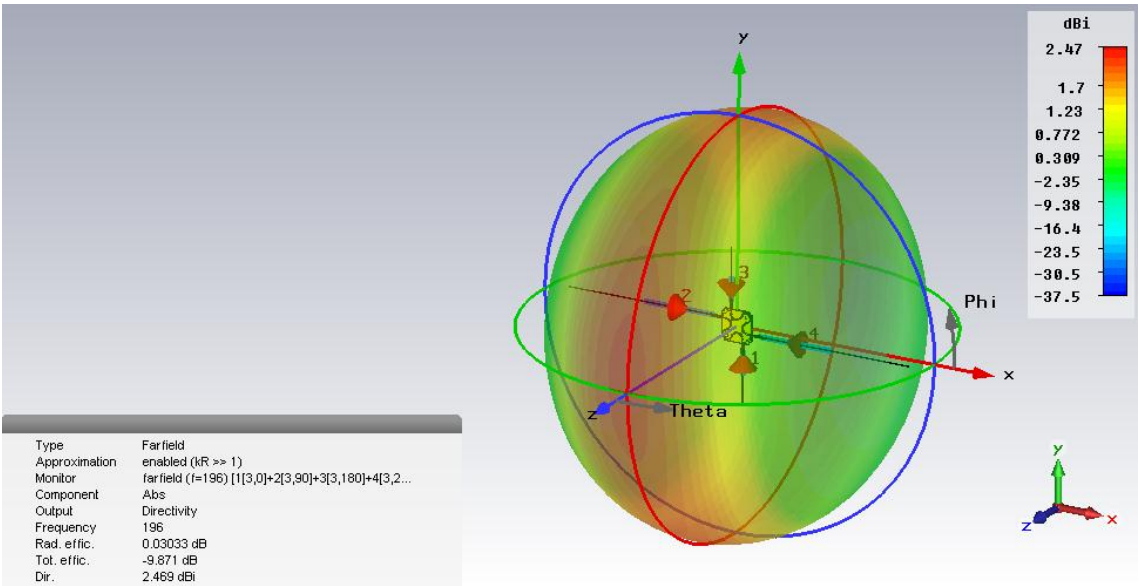


Figure 22. A1-Turnstile. 3D Directivity Pattern (196 MHz).

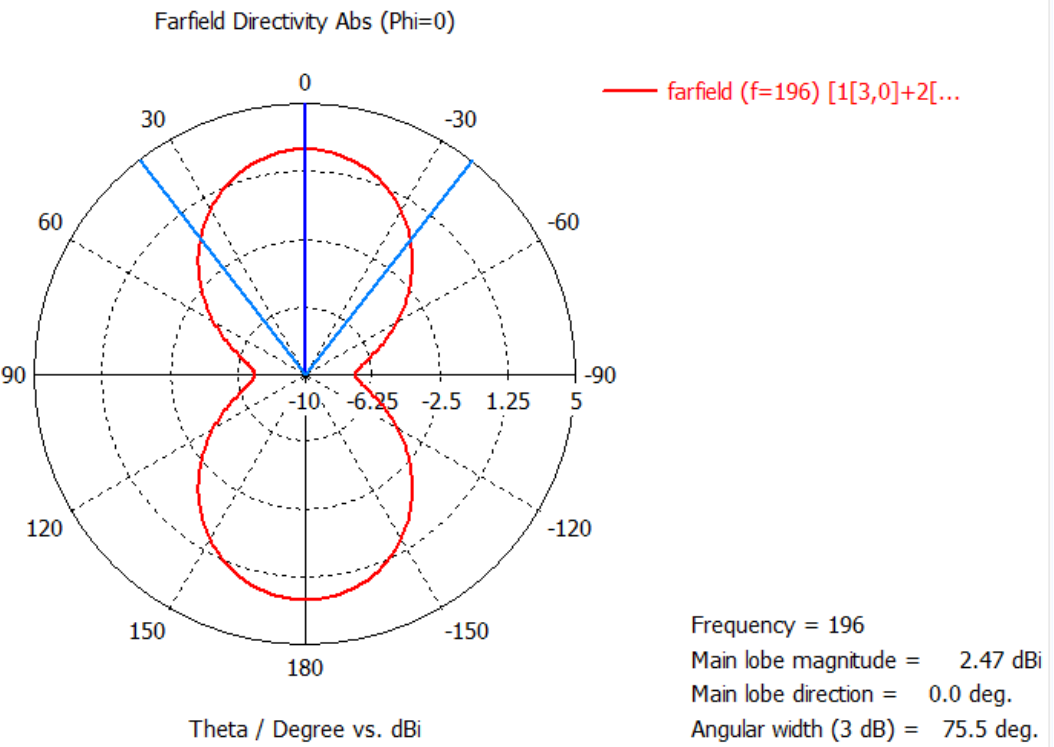


Figure 23. A1-Turnstile. Directivity Polar Diagram (196 MHz).

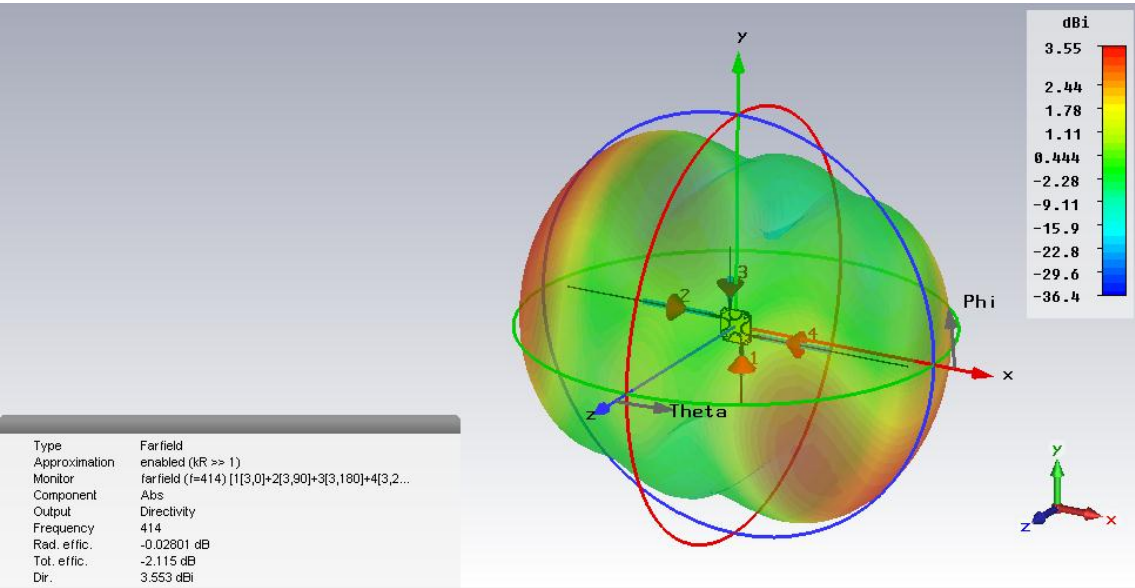


Figure 24. A1-Turnstile. 3D Directivity Pattern (414 MHz).

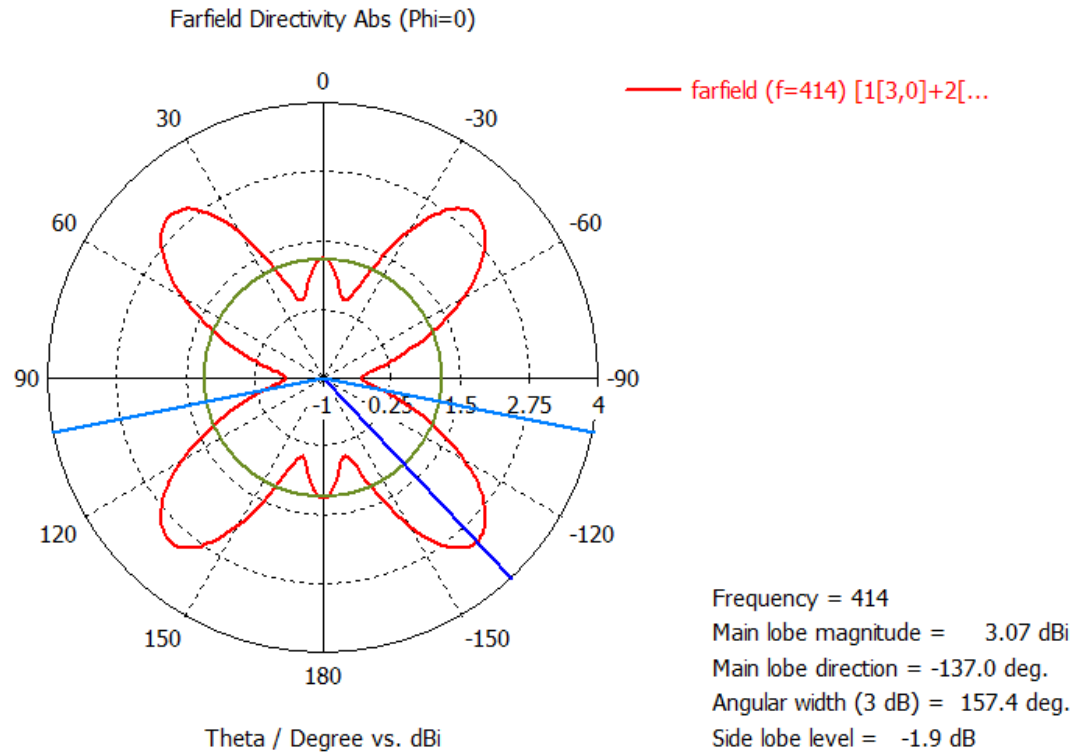


Figure 25. A1-Turnstile. Directivity Polar Diagram (414 MHz).

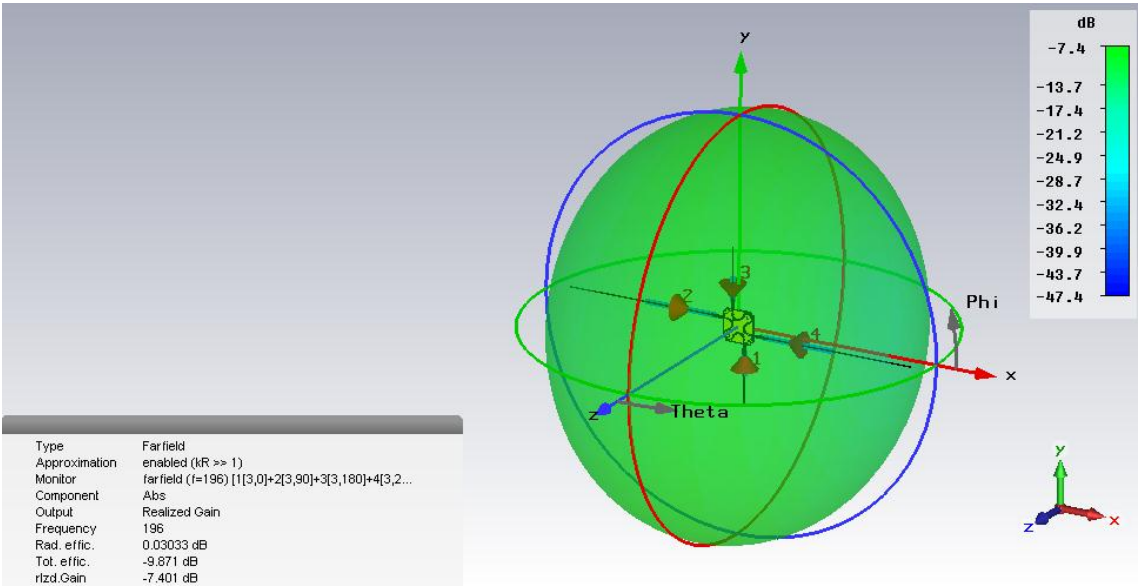


Figure 26. A1-Turnstile. 3D Realized Gain Pattern (196 MHz).

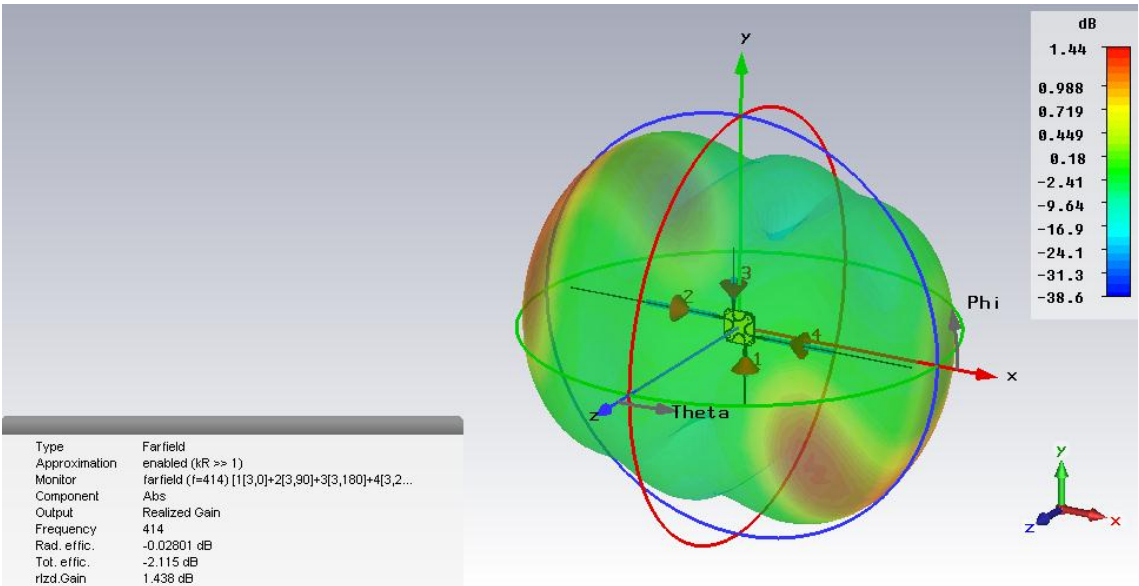


Figure 27. A1-Turnstile. 3D Realized Gain Pattern (414 MHz).

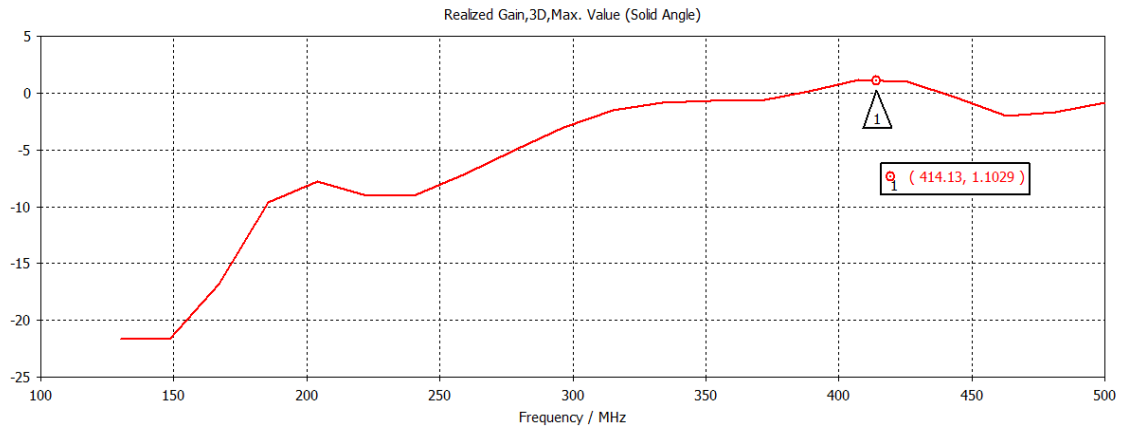


Figure 28. A1-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P1 and P3.

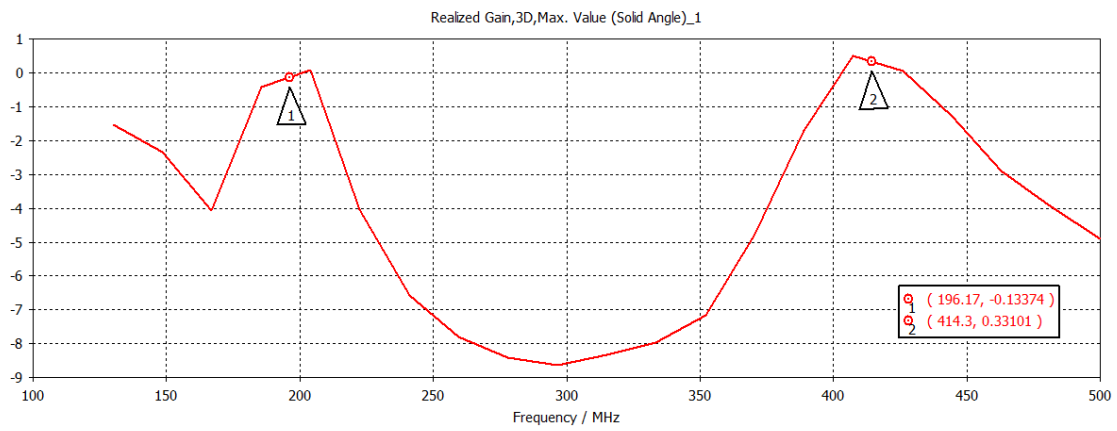


Figure 29. A1-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P2 and P4.

A.1.3.3 Efficiency

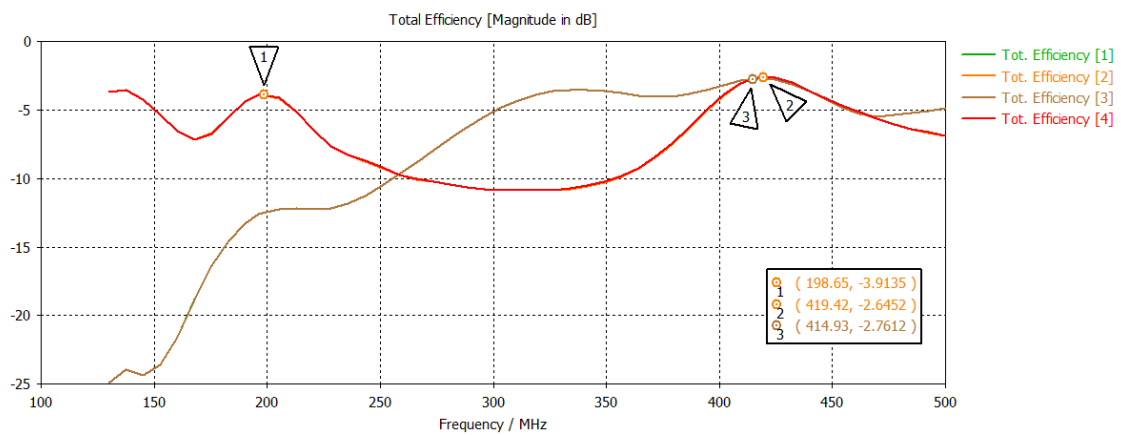


Figure 30. A1-Turnstile. Antenna efficiency dependent on range frequency 130-500 MHz.

A.1.3.4 Electric field

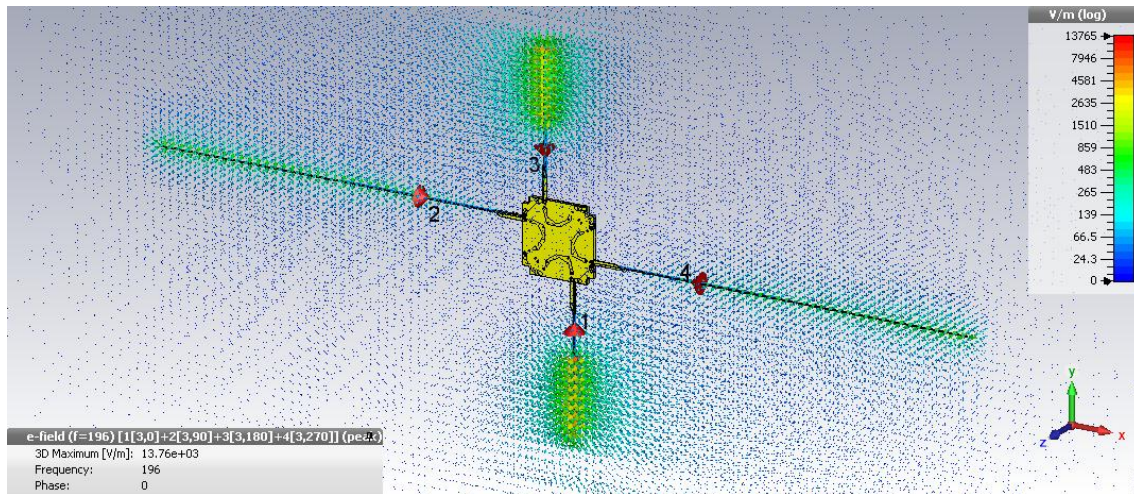


Figure 31. A1-Turnstile. Electric field (196 MHz).

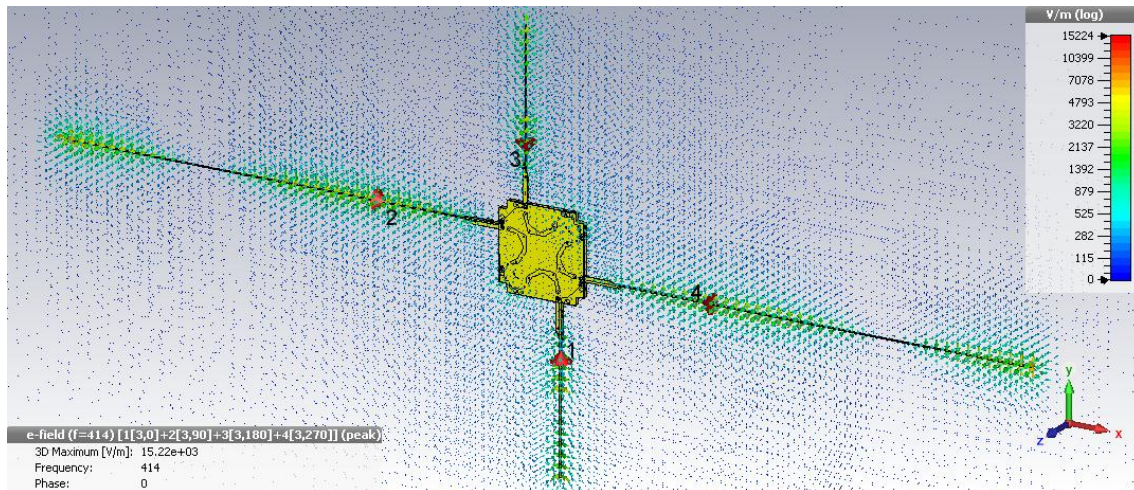


Figure 32. A1-Turnstile. Electric field (414 MHz).

A.1.3.5 Magnetic field

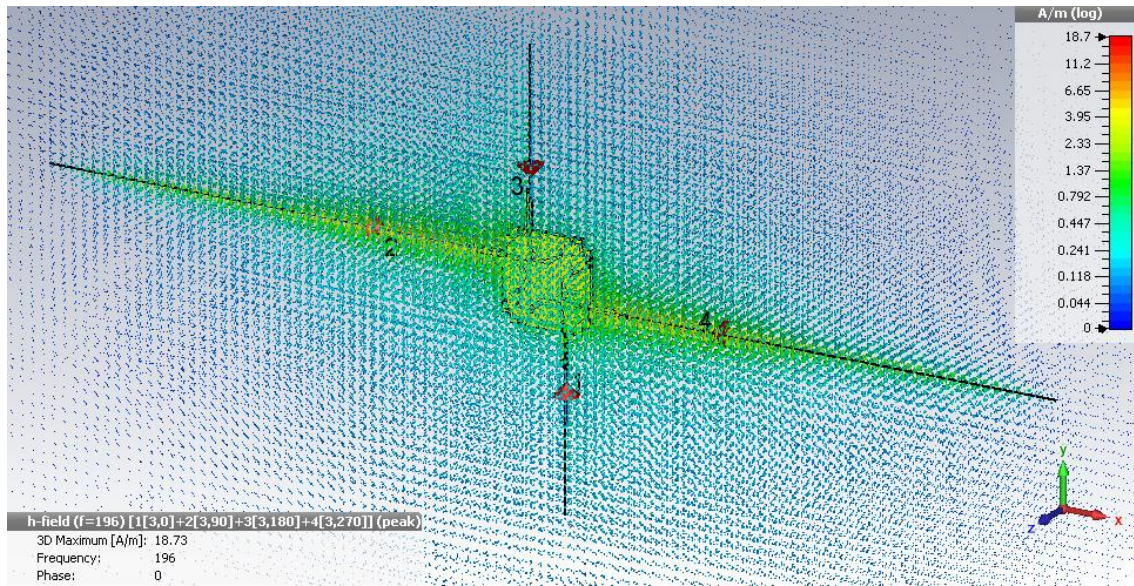


Figure 33. A1-Turnstile. Magnetic field (196 MHz).

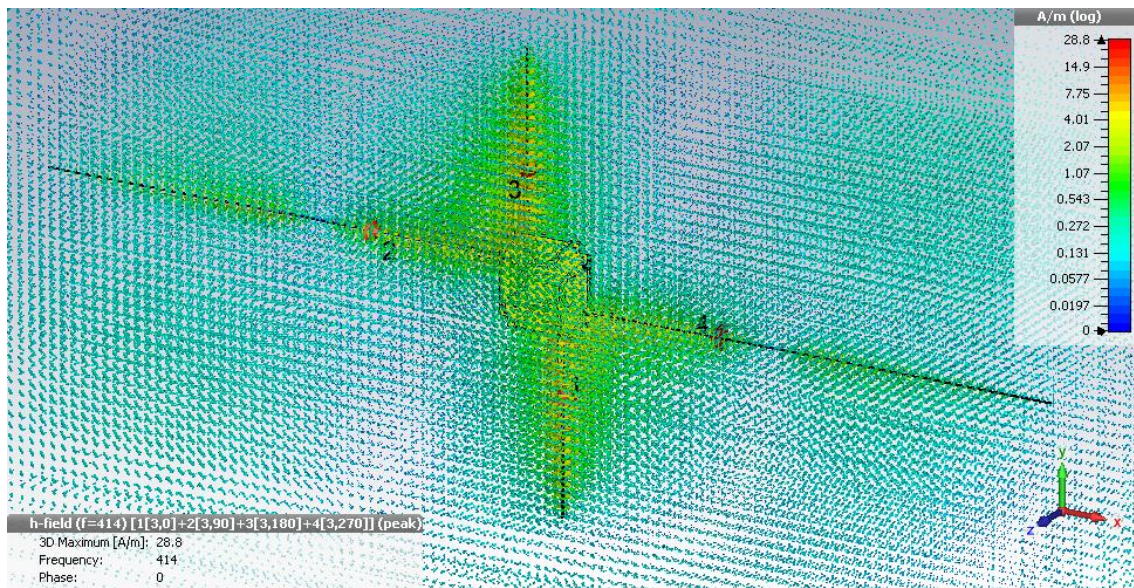


Figure 34. A1-Turnstile. Magnetic field (414 MHz).

A.2 3U UHF antenna

A.2.1 Monopole P1

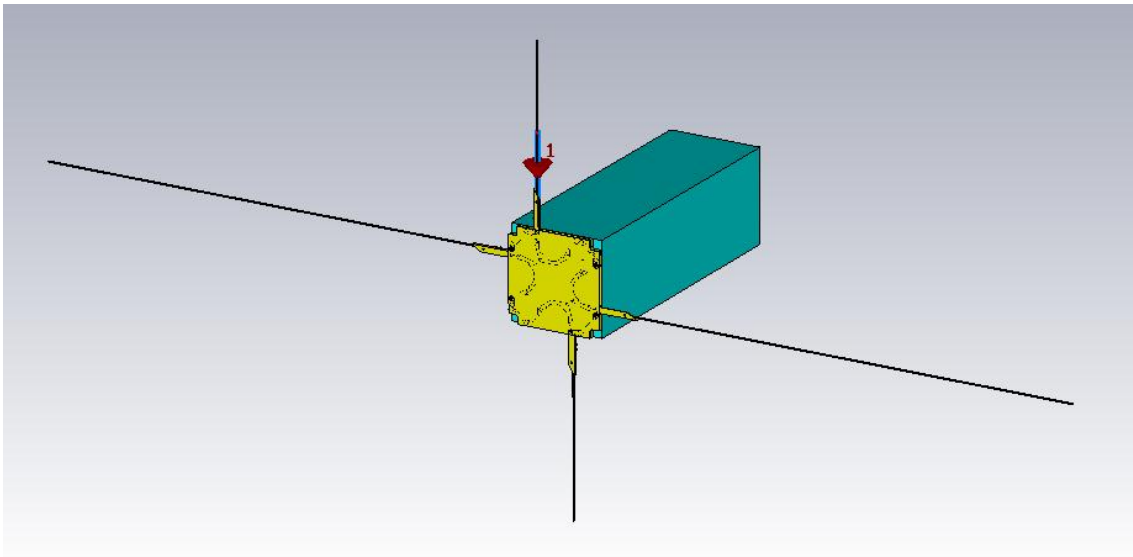


Figure 35. A2-P1. 3U UHF antenna CAD model.

A.2.1.1 Scattering Parameters (S – Parameters)

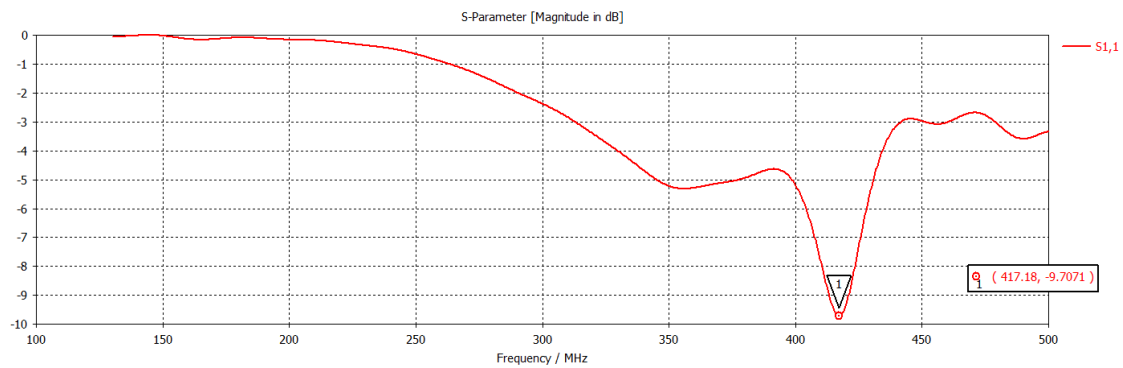


Figure 36. A2-P1. Return loss.

A.2.1.2 Radiation Pattern

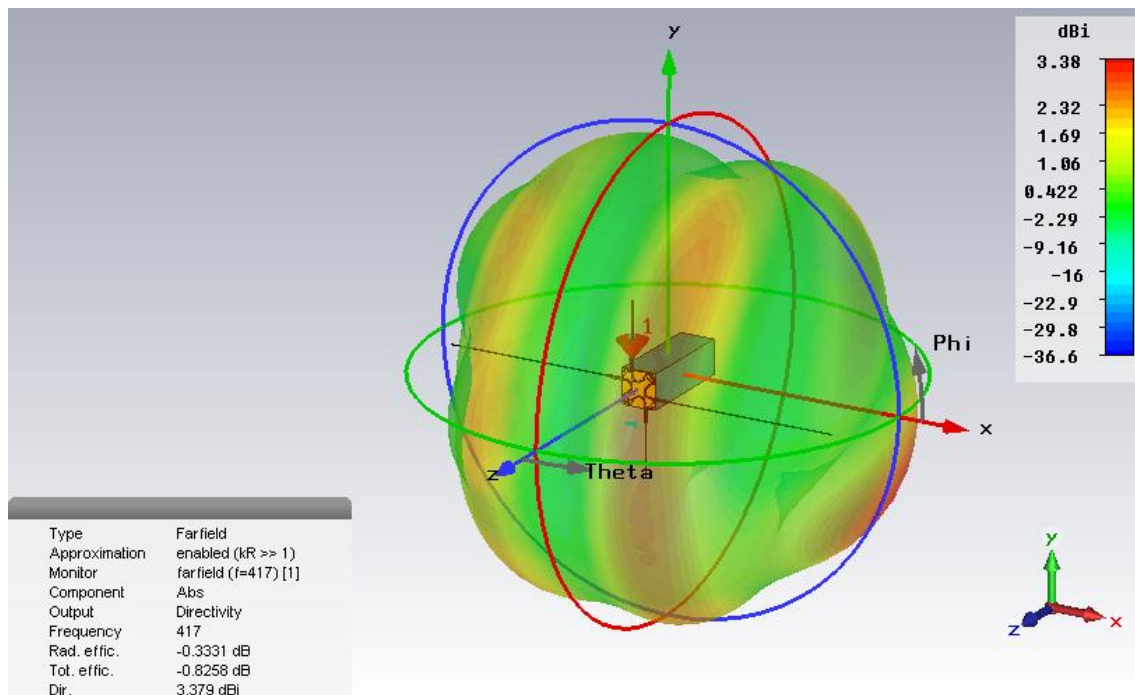


Figure 37. A2-P1. 3D Directivity Pattern (417 MHz).

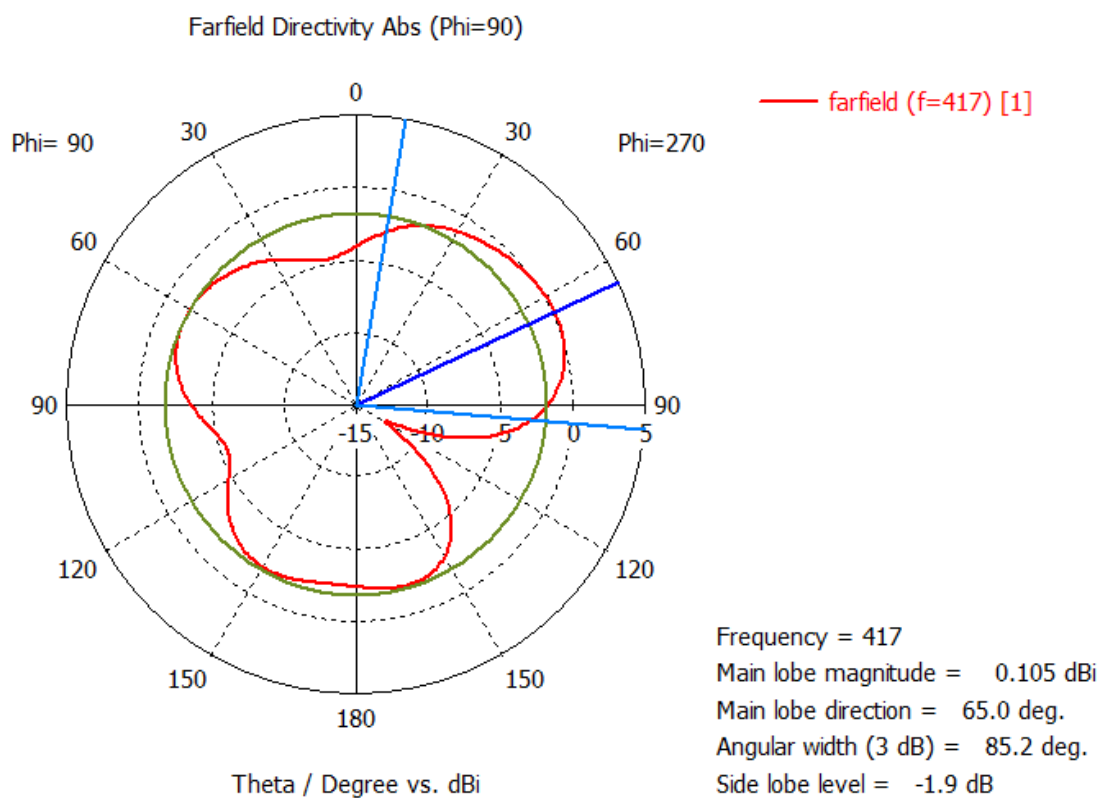


Figure 38. A2-P1. Directivity Polar Diagram (417 MHz).

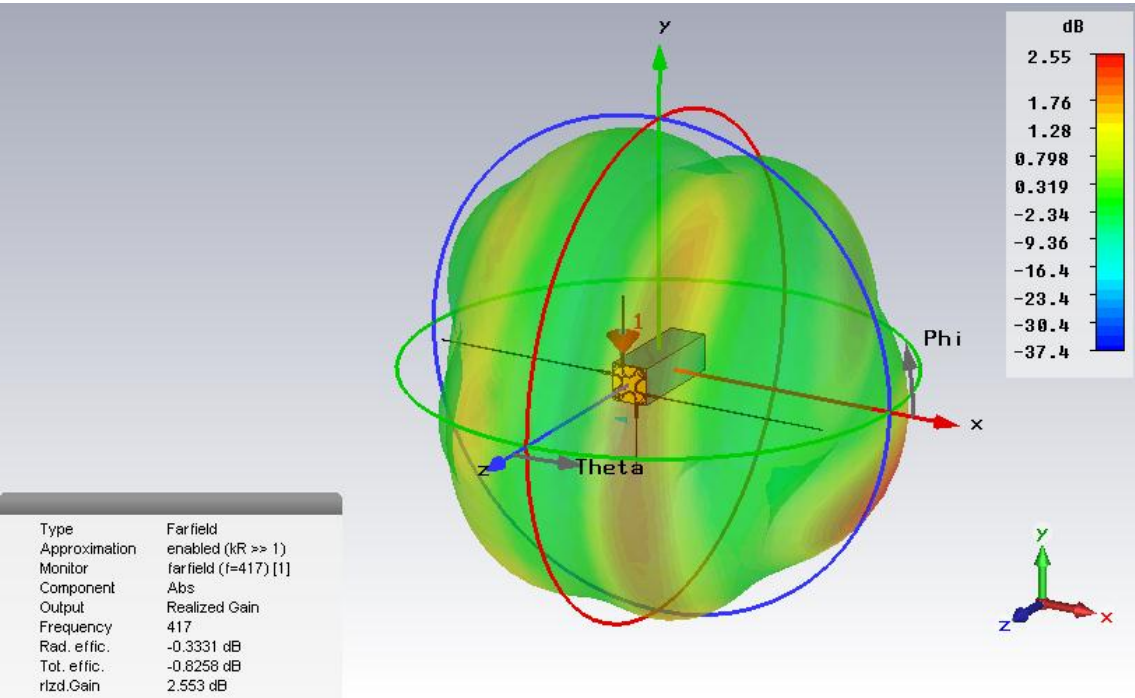


Figure 39. A2-P1. 3D Realized Gain Pattern (417 MHz).

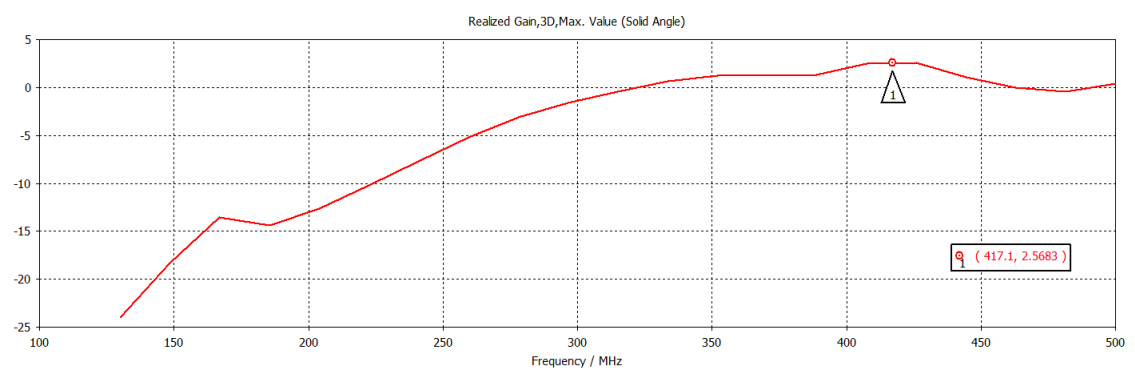


Figure 40. A2-P1. Realized Gain dependent on range frequency 130-500 MHz.

A.2.1.3 Efficiency

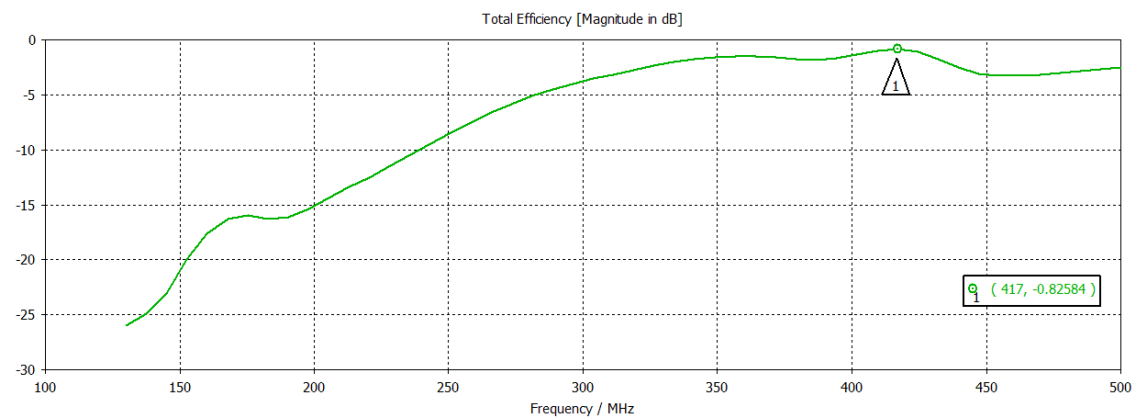


Figure 41. A2-P1. Antenna efficiency dependent on range frequency 130-500 MHz.

A.2.1.4 Electric field

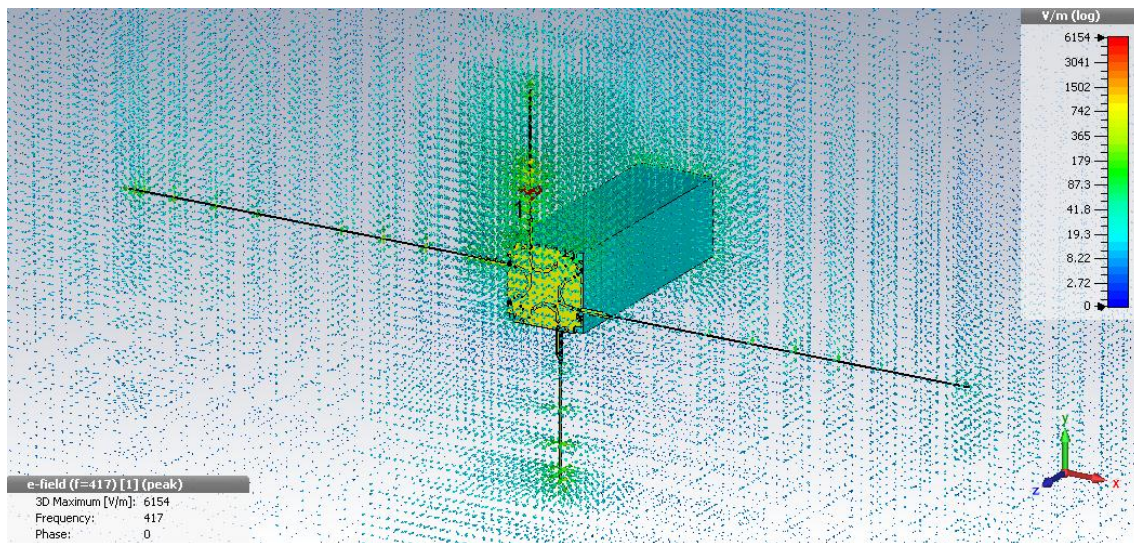


Figure 42. A2-P1. Electric field (417 MHz).

A.2.1.5 Magnetic field

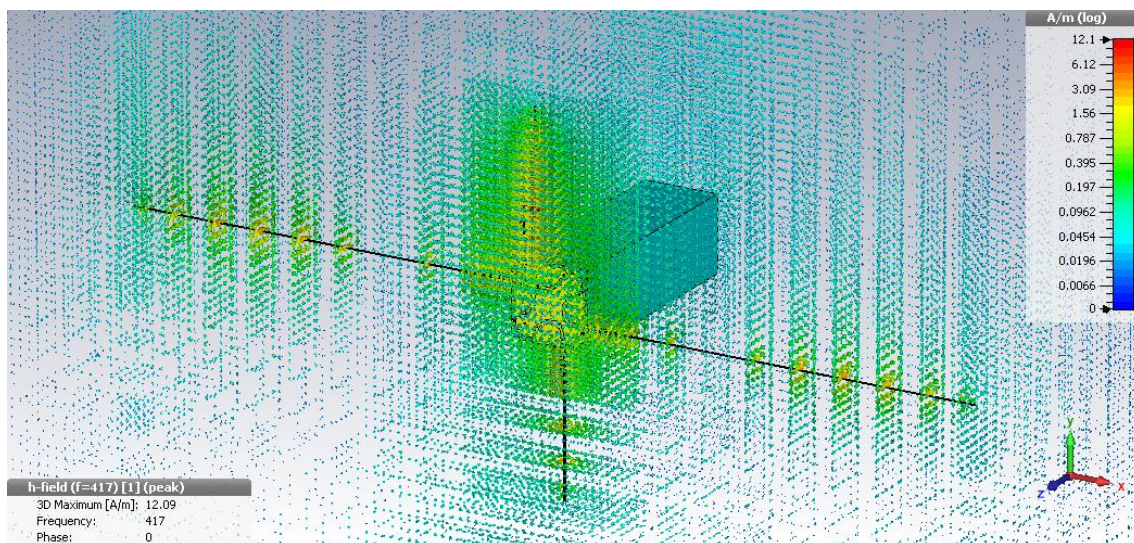


Figure 43. A2-P1. Magnetic field (417 MHz).

A.2.2 Monopole P2

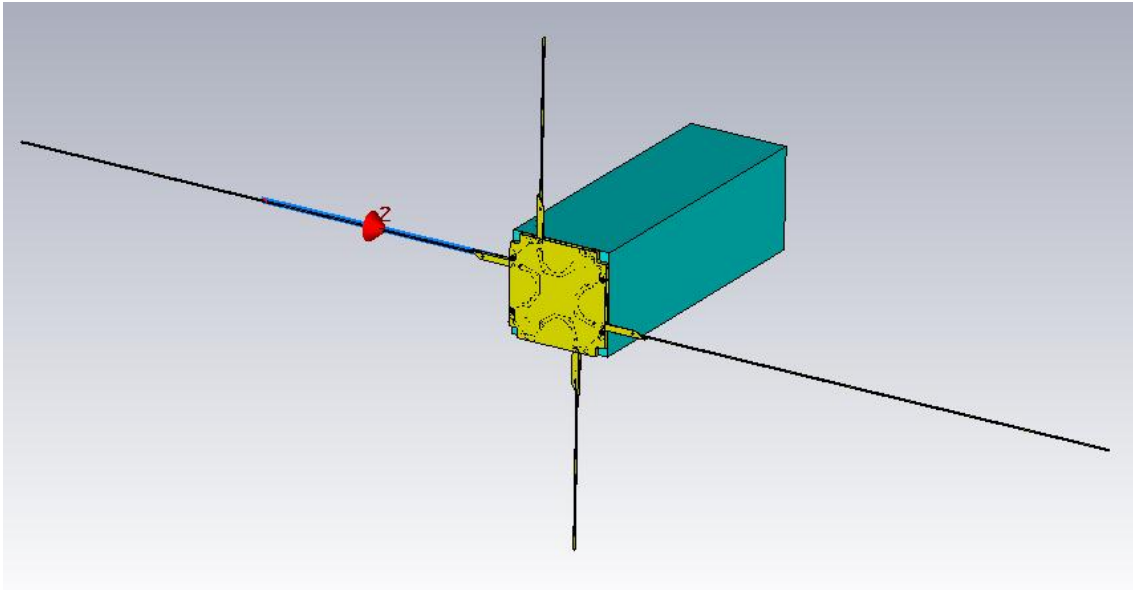


Figure 44. A2-P2. 3U UHF antenna CAD model.

A.2.2.1 Scattering Parameters (S – Parameters)

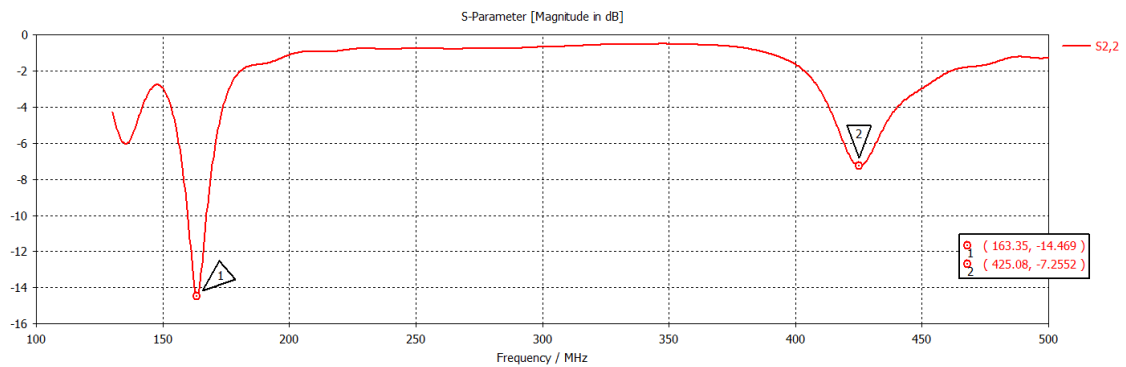


Figure 45. A2-P2. Return loss.

A.2.2.2 Radiation Pattern

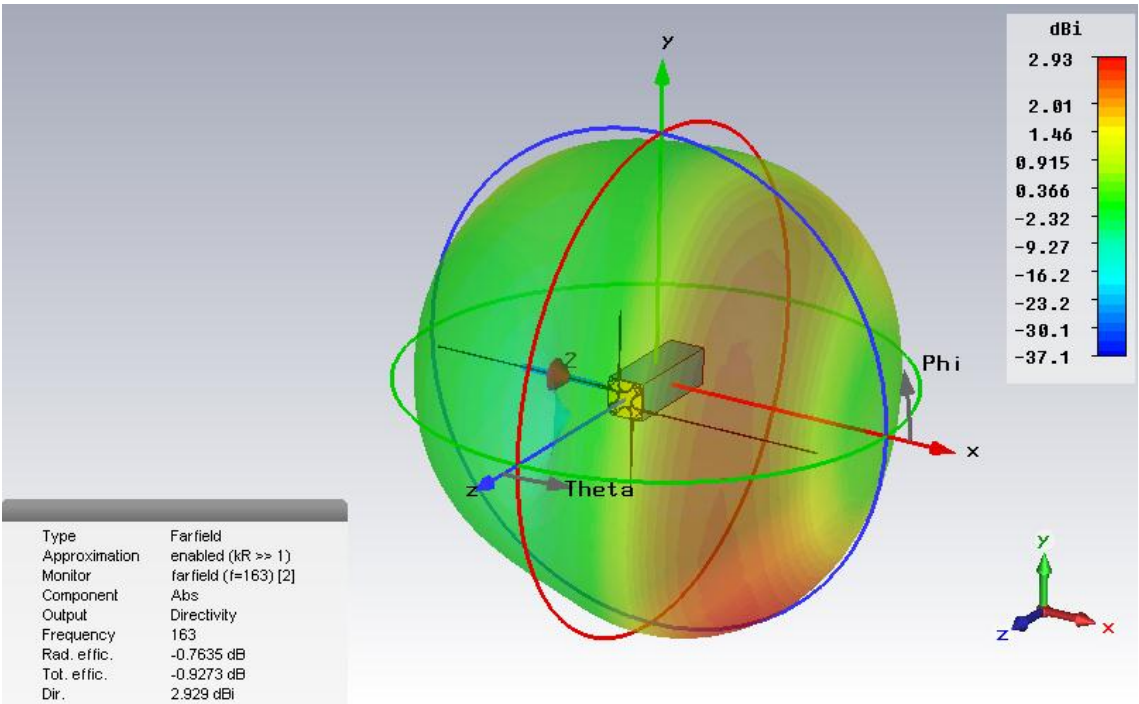


Figure 46. A2-P2. 3D Directivity Pattern (163 MHz).

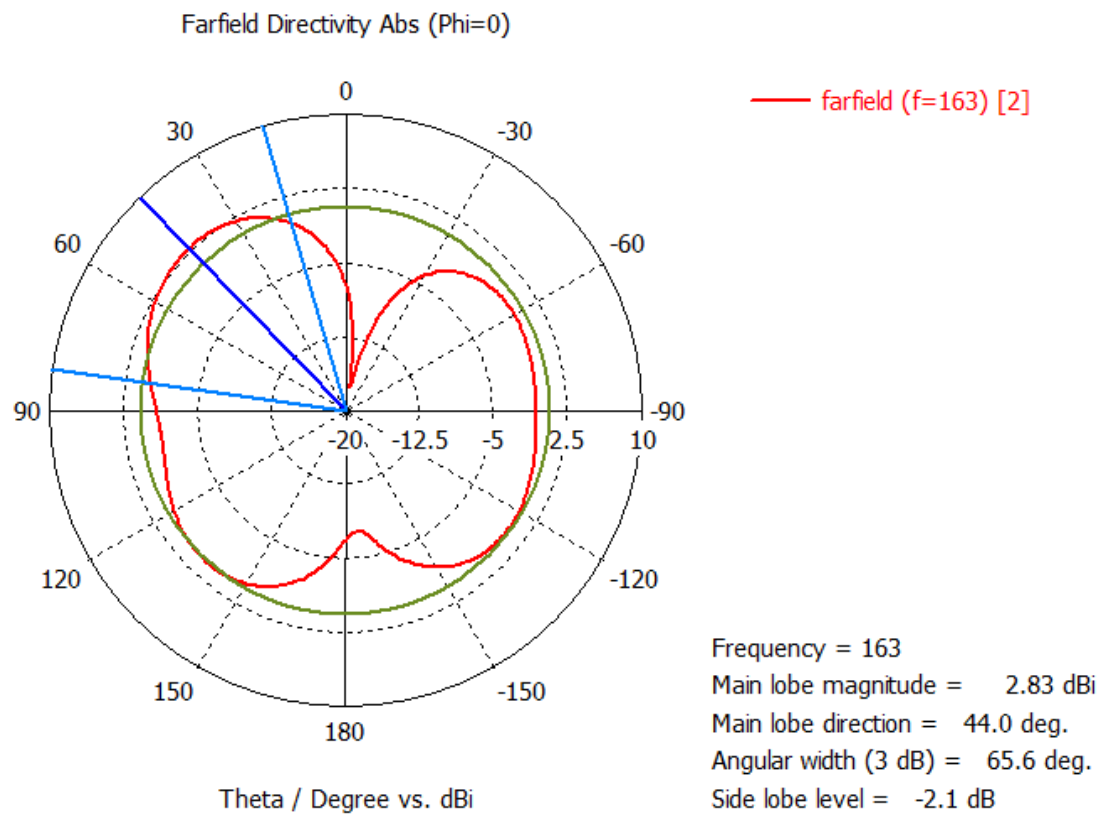


Figure 47. A2-P2. Directivity Polar Diagram (163 MHz).

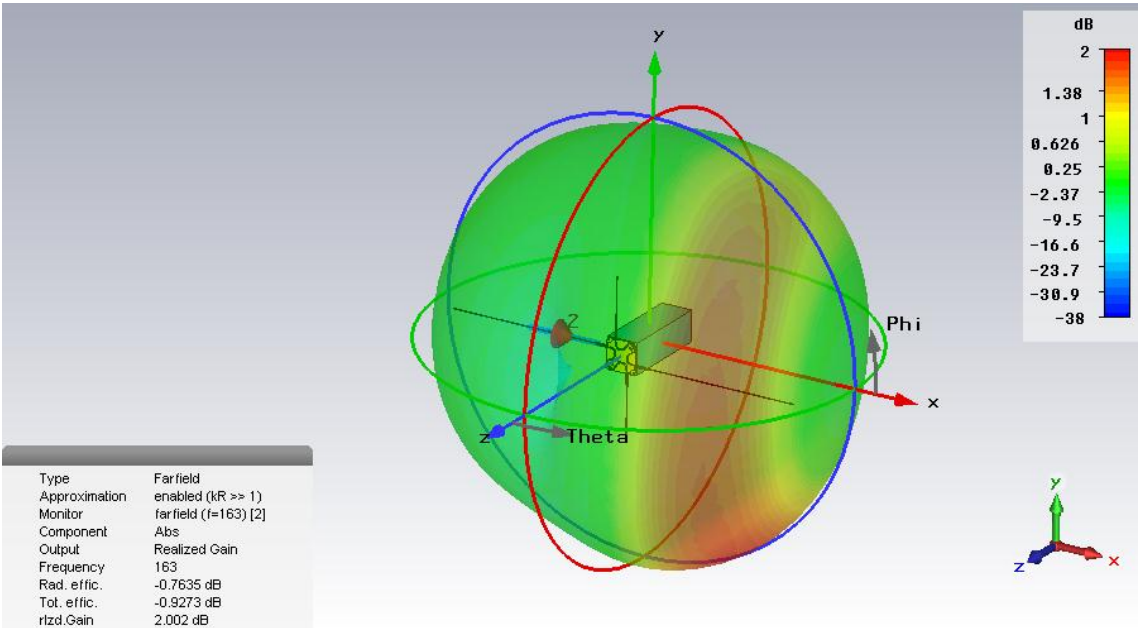


Figure 48. A2-P2. 3D Realized Gain Pattern (163 MHz).

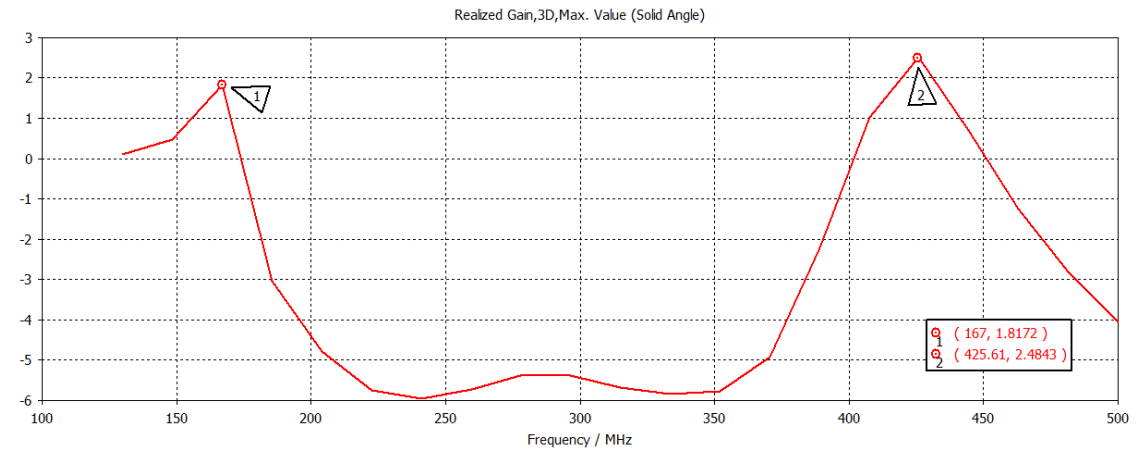


Figure 49. A2-P2. Realized Gain dependent on range frequency 130-500 MHz.

A.2.2.3 Efficiency

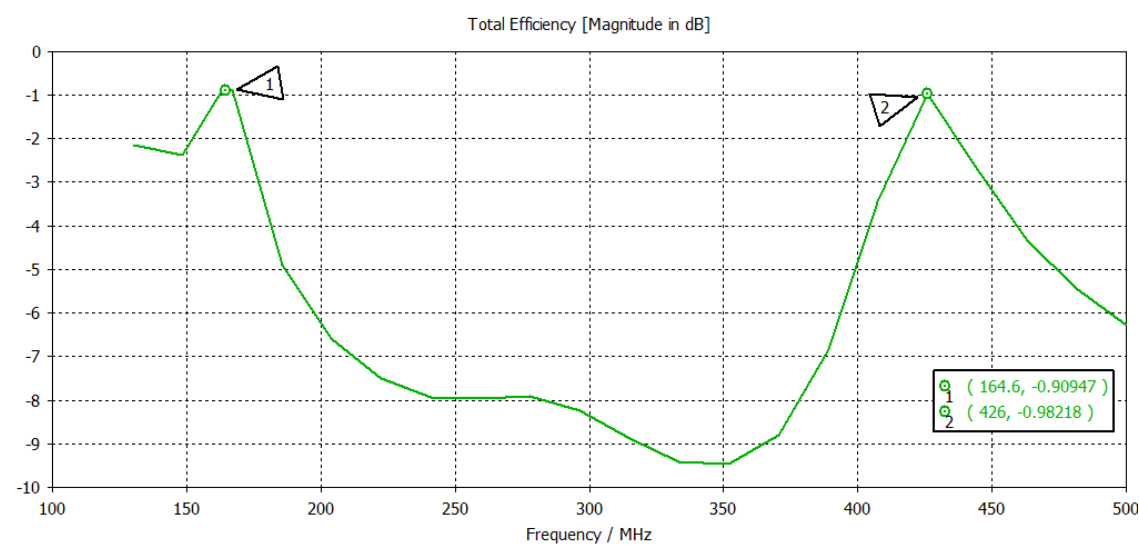


Figure 50. A2-P2. Antenna efficiency dependent on range frequency 130-500 MHz.

A.2.2.4 Electric field

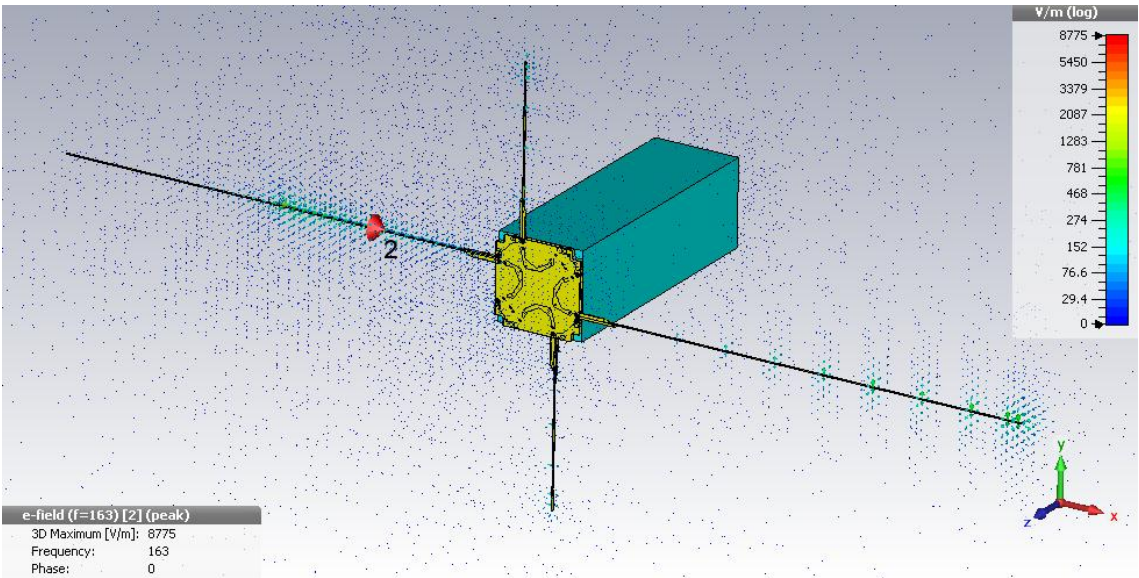


Figure 51. A2-P2. Electric field (163 MHz).

A.2.2.5 Magnetic field

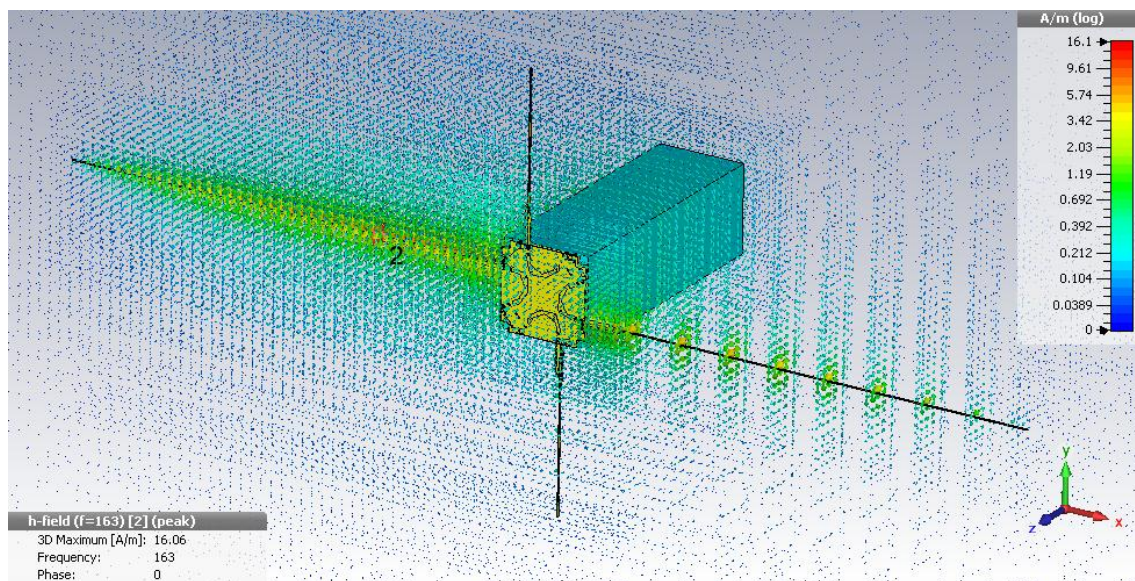


Figure 52. A2-P2. Magnetic field (163 MHz).

A.2.3 Dipole P1 & P3

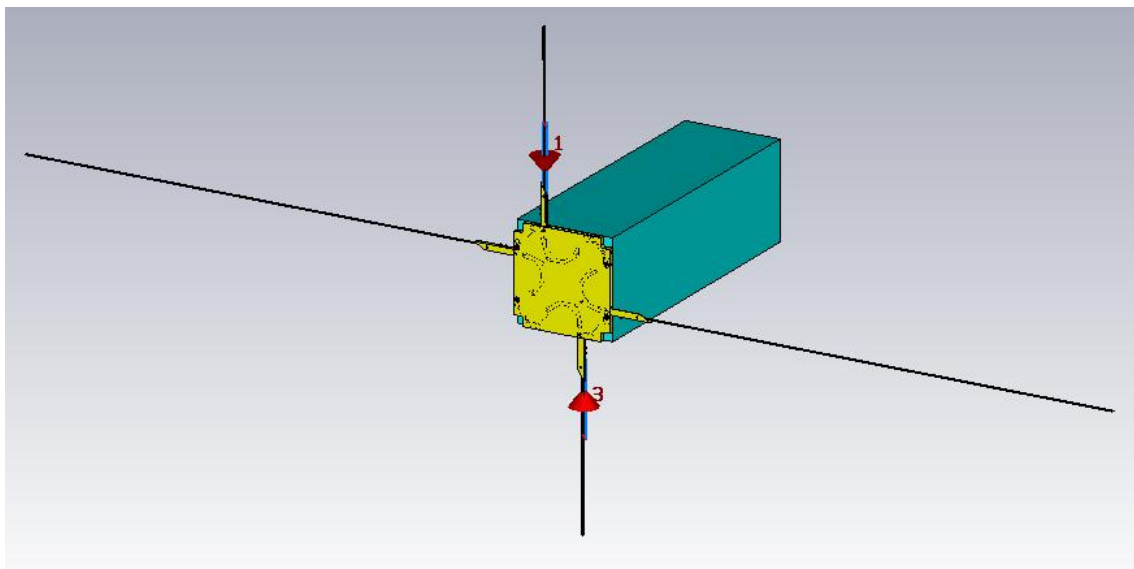


Figure 53. A2-Dipole. 3U UHF antenna CAD model.

A.2.3.1 Scattering Parameters (S – Parameters)

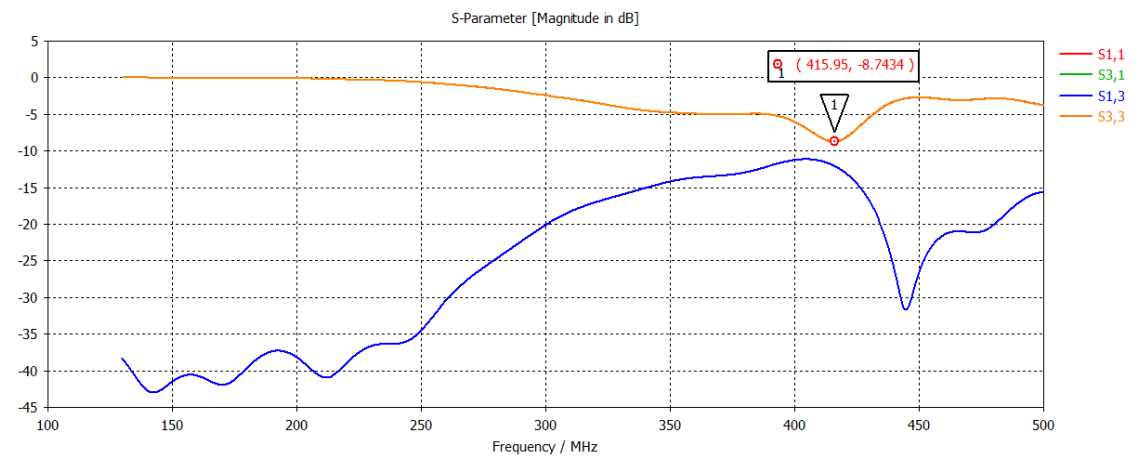


Figure 54. A2-Dipole. Return loss and insertion loss.

A.2.3.2 Radiation Pattern

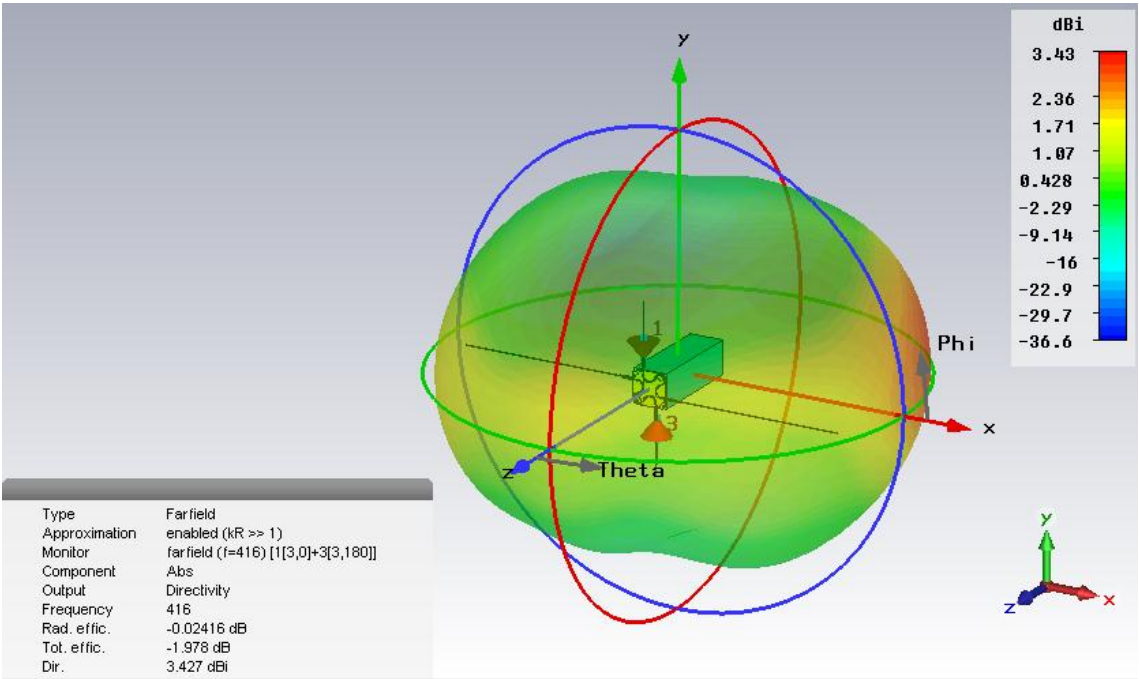


Figure 55. A2-Dipole. 3D Directivity Pattern (416 MHz).

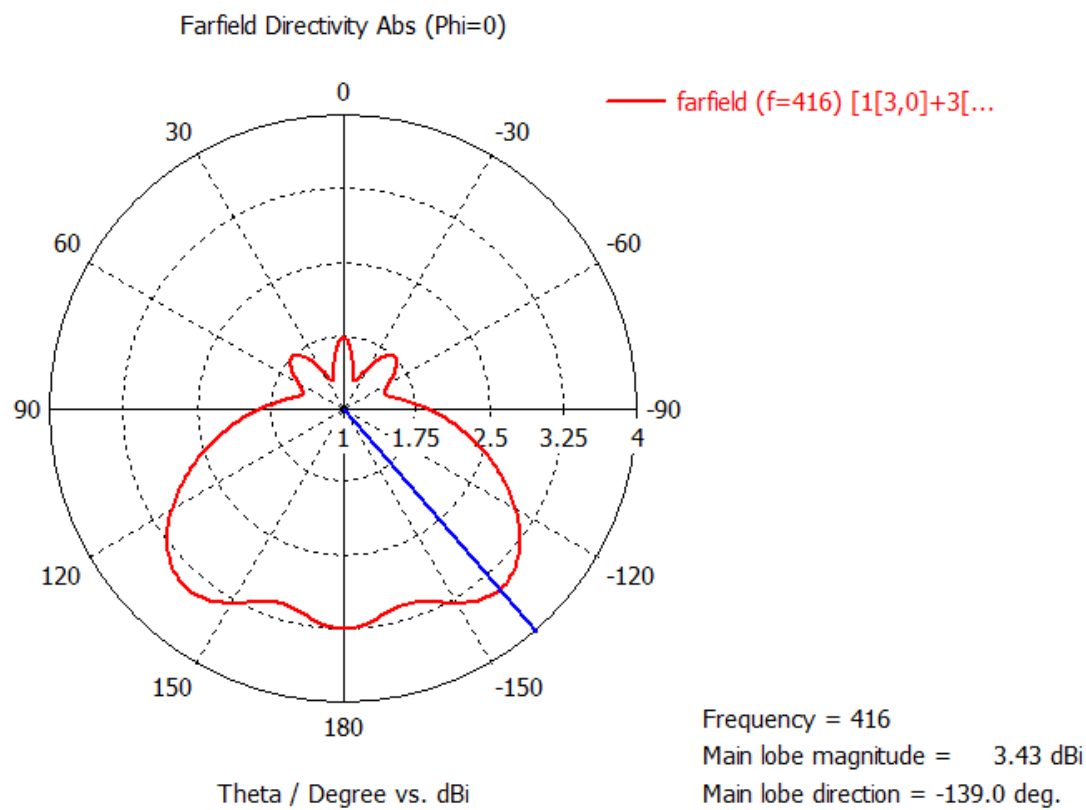


Figure 56. A2-Dipole. Directivity Polar Diagram (416 MHz).

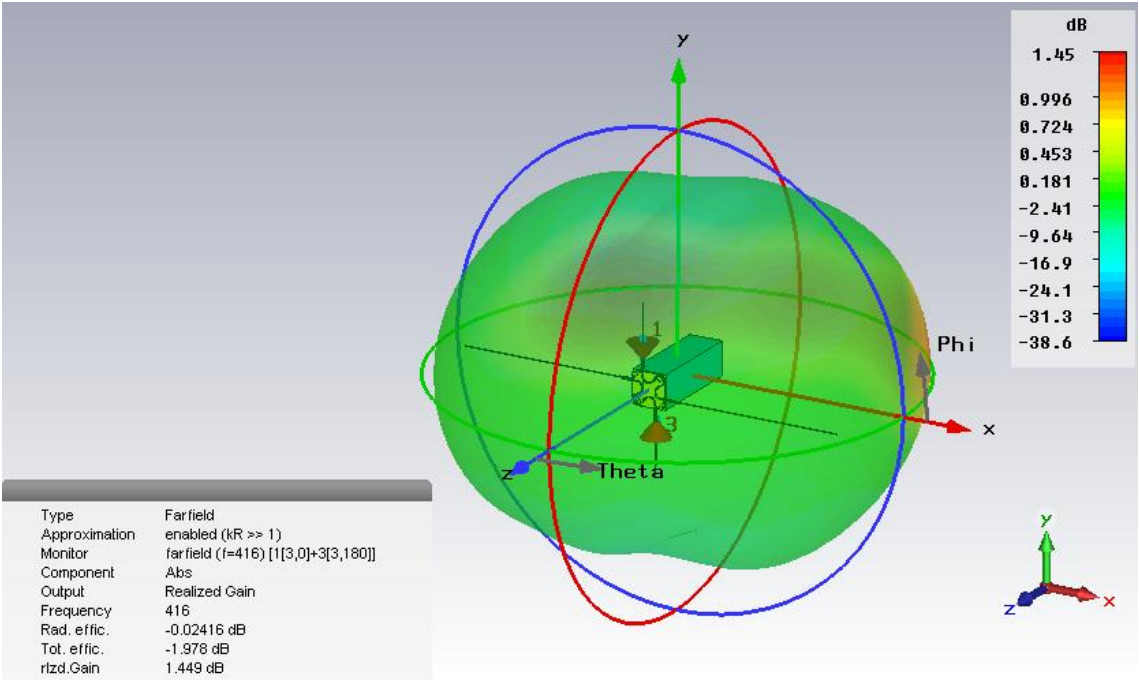


Figure 57. A2-Dipole. 3D Realized Gain Pattern (416 MHz).

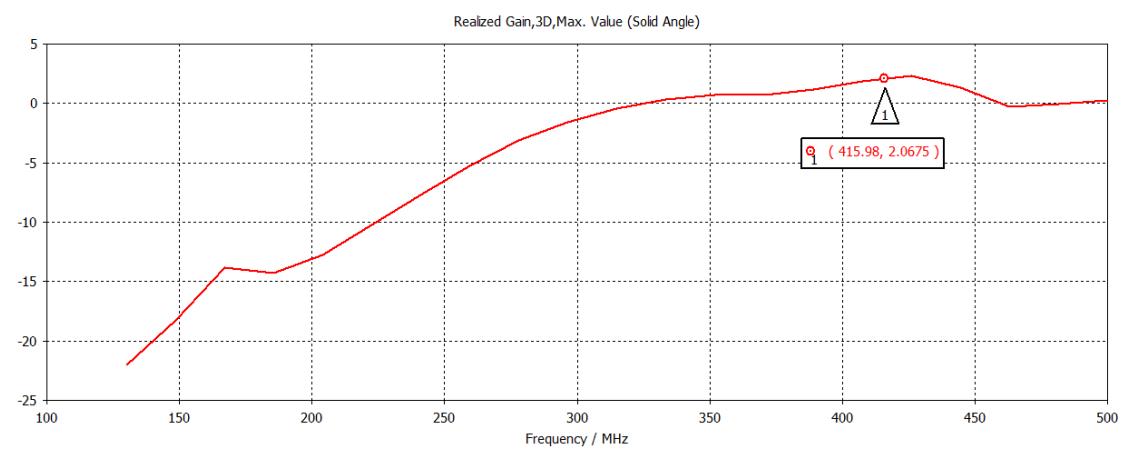


Figure 58. A2-Dipole. Realized Gain dependent on range frequency 130-500 MHz.

A.2.3.3 Efficiency

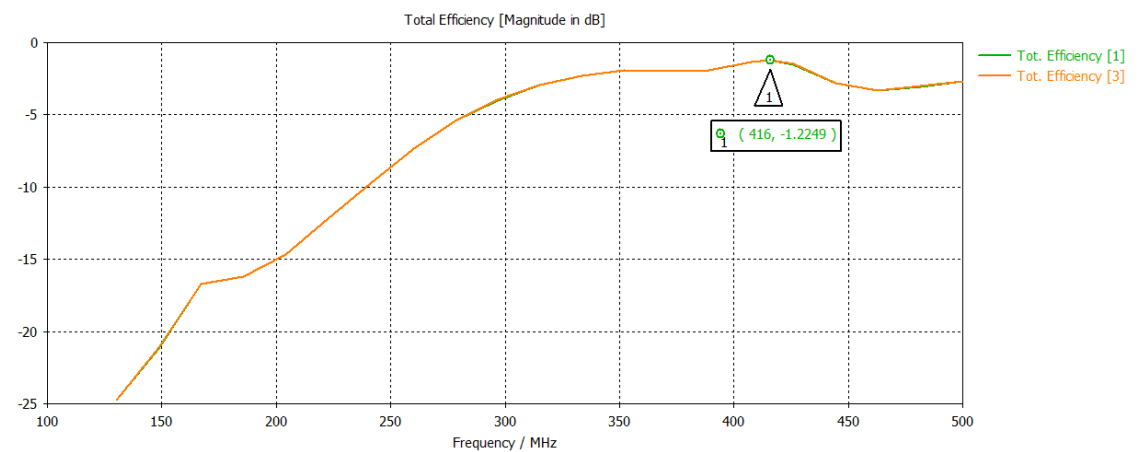


Figure 59. A2-Dipole. Antenna efficiency dependent on range frequency 130-500 MHz.

A.2.3.4 Electric field

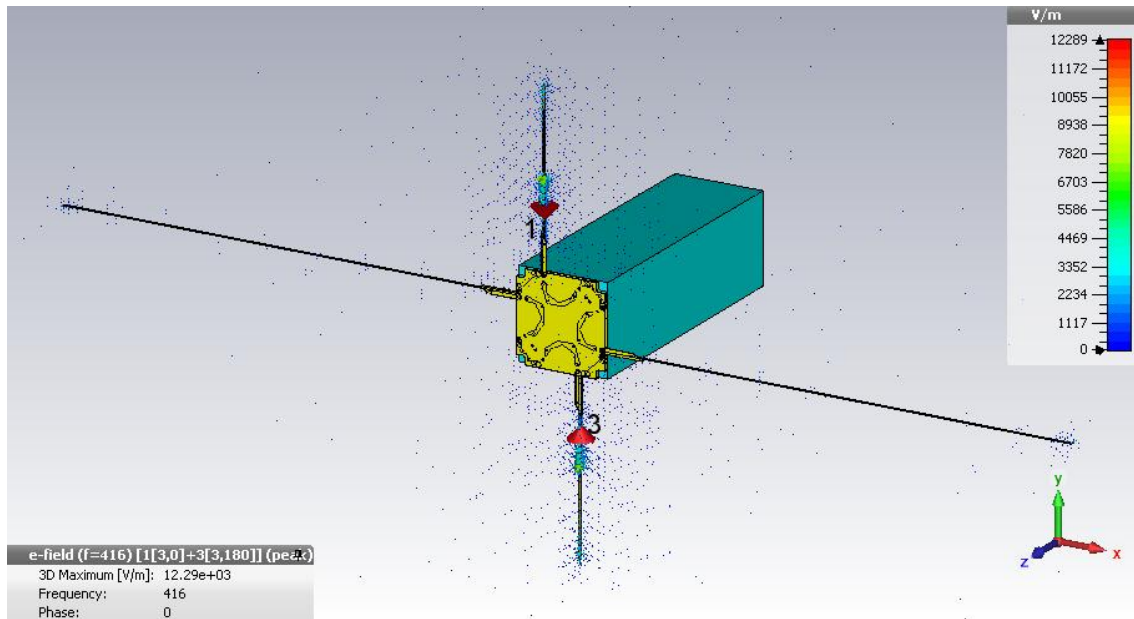


Figure 60. A2-Dipole. Electric field (416 MHz).

A.2.3.5 Magnetic field

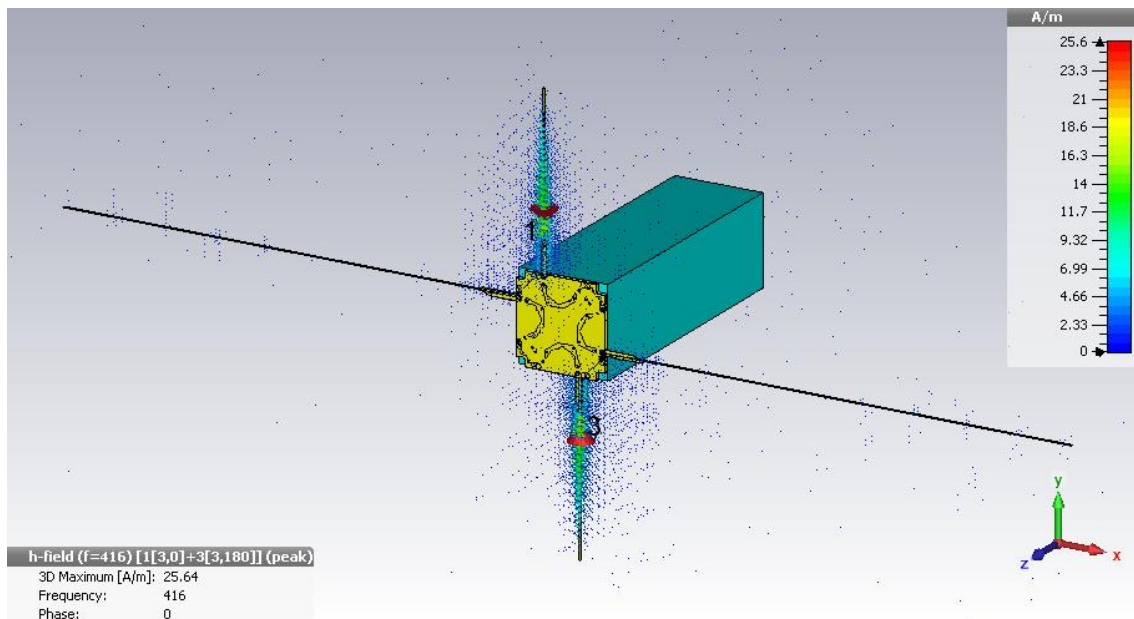


Figure 61. A2-Dipole. Magnetic field (416 MHz).

A.2.4 Turnstile: All Ports

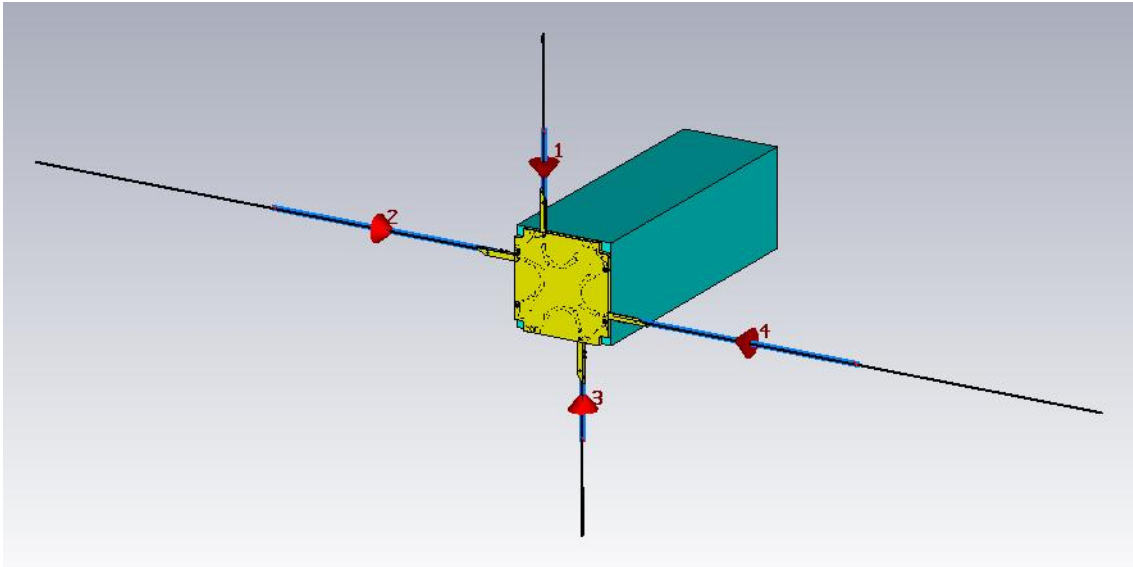


Figure 62. A2-Turnstile. 3U UHF antenna CAD model.

A.2.4.1 Scattering Parameters (S – Parameters)

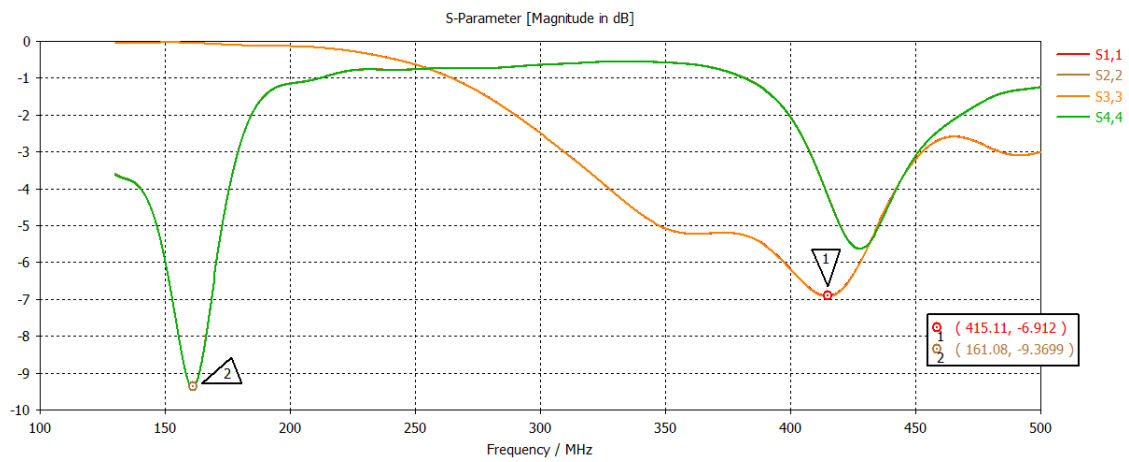


Figure 63. A2-Turnstile. Return loss.

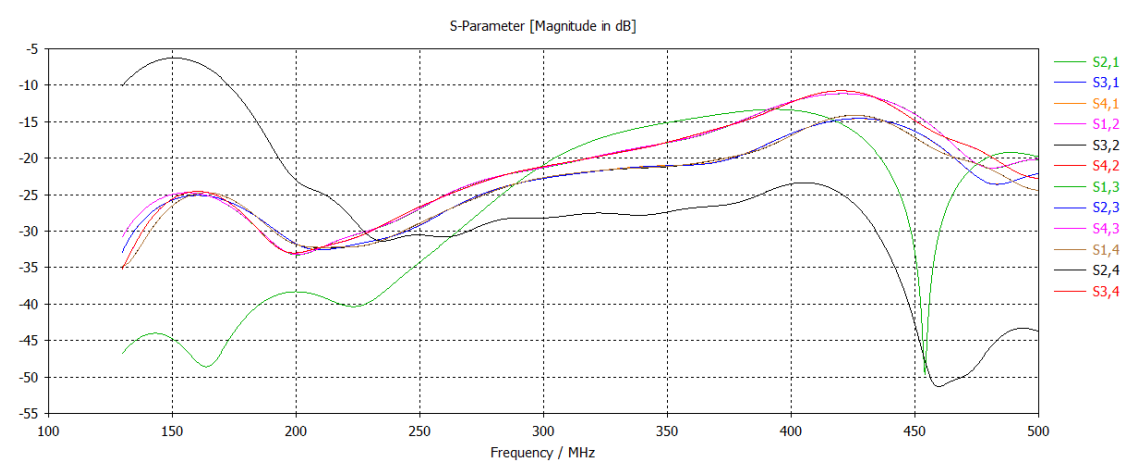


Figure 64. A2-Turnstile. Insertion loss.

A.2.4.2 Radiation Pattern

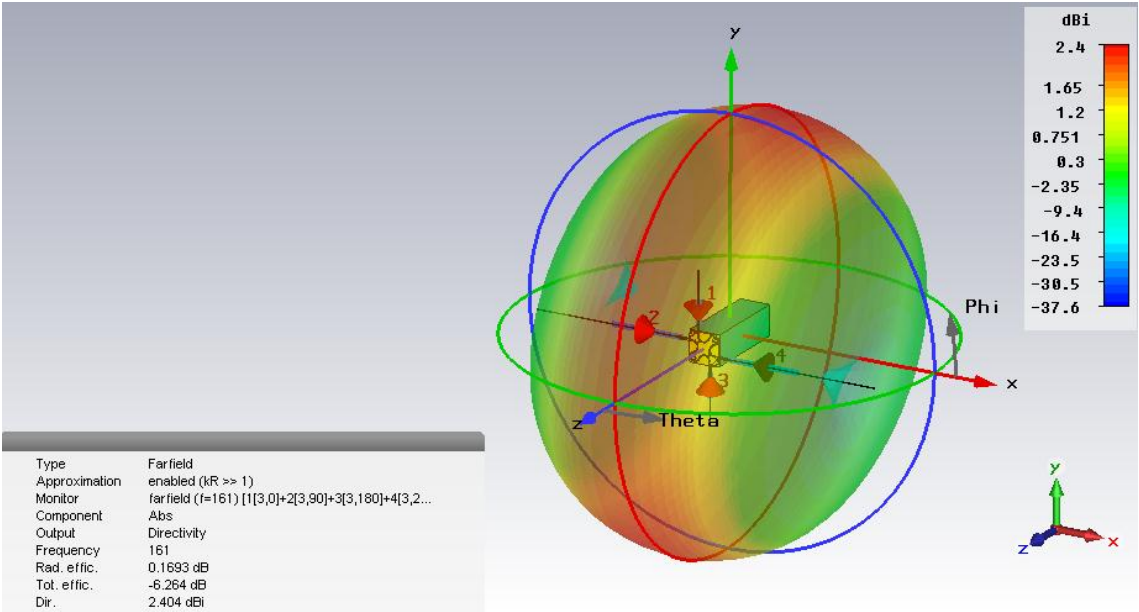


Figure 65. A2-Turnstile. 3D Directivity Pattern (161 MHz).

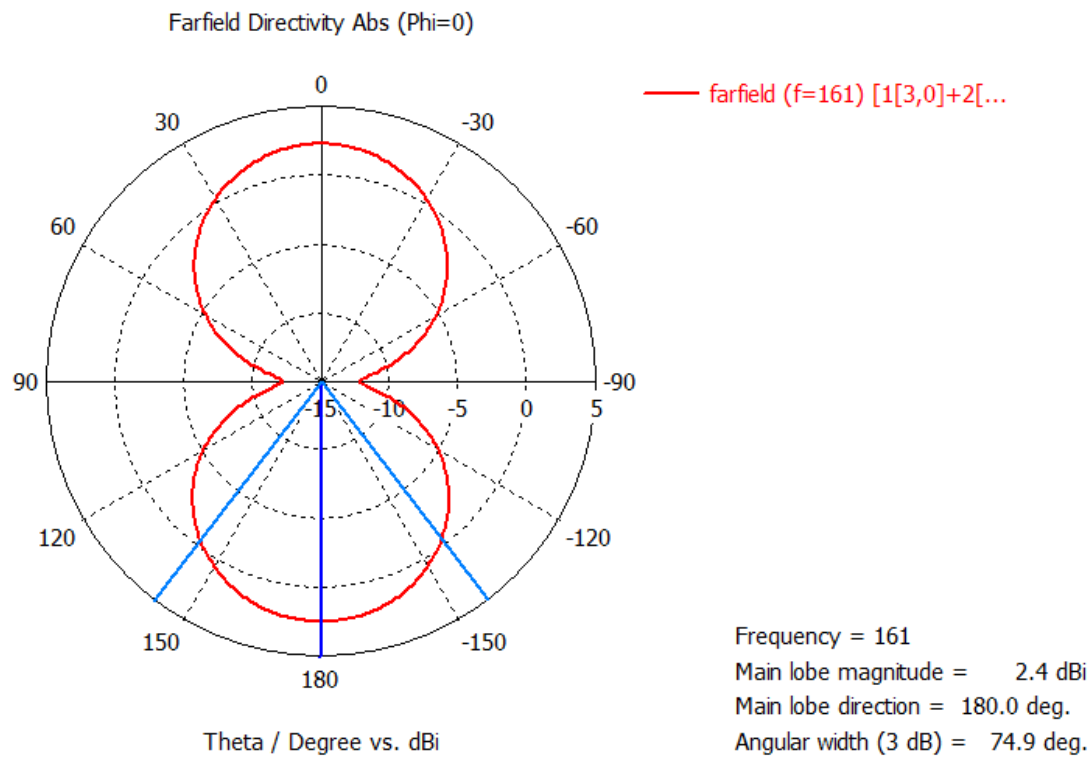


Figure 66. A2-Turnstile. Directivity Polar Diagram (161 MHz).

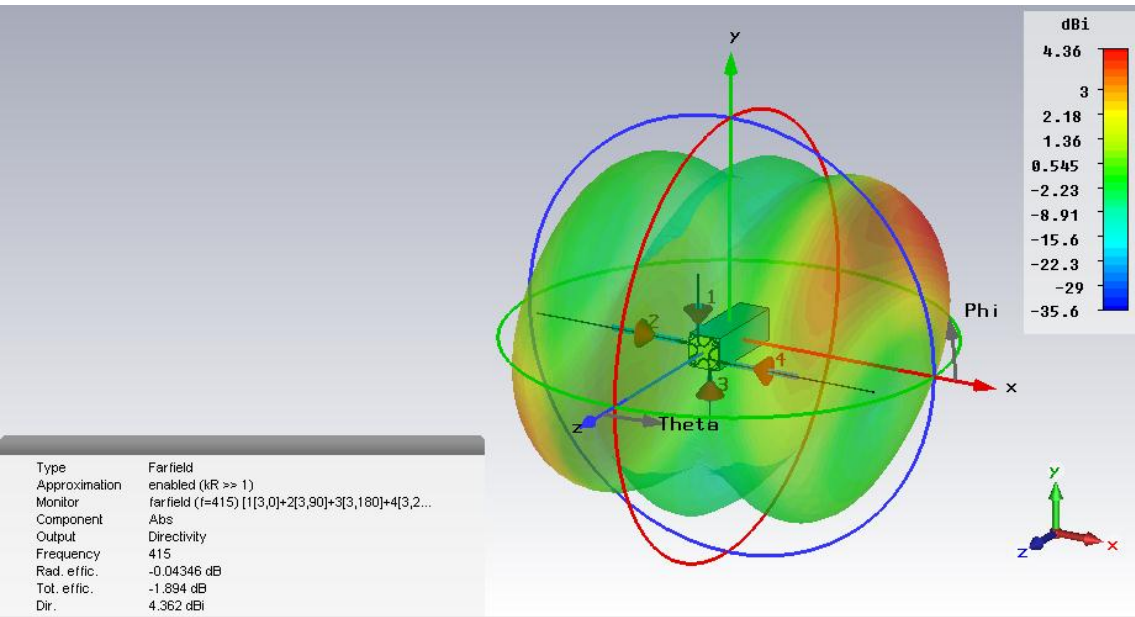


Figure 67. A2-Turnstile. 3D Directivity Pattern (415 MHz).

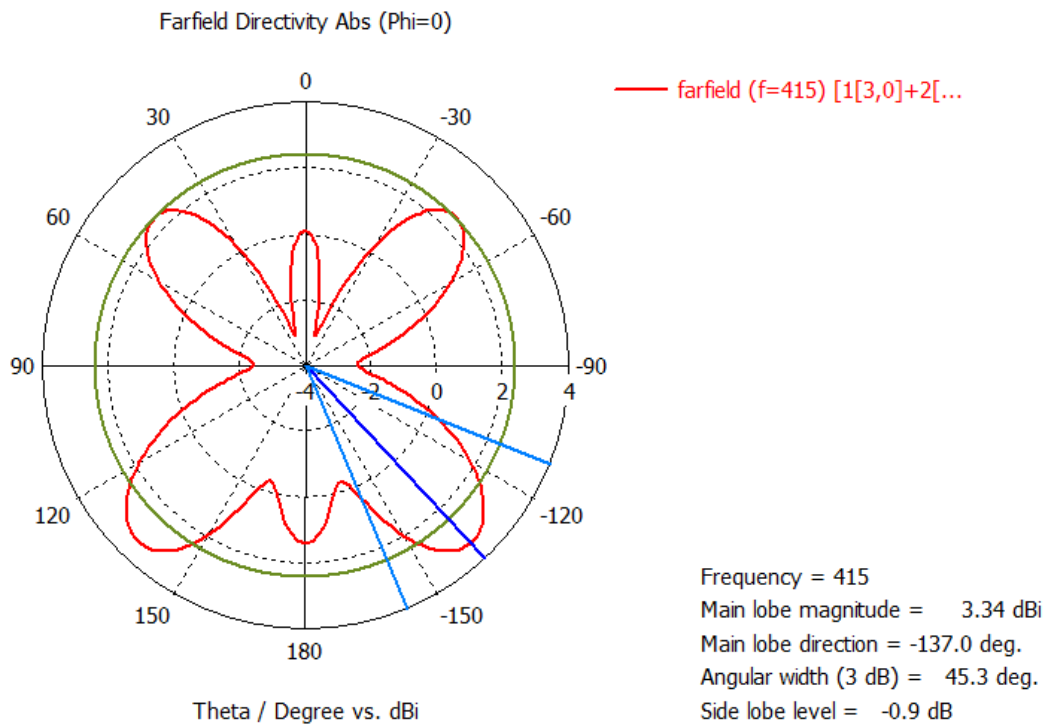


Figure 68. A2-Turnstile. Directivity Polar Diagram (415 MHz).

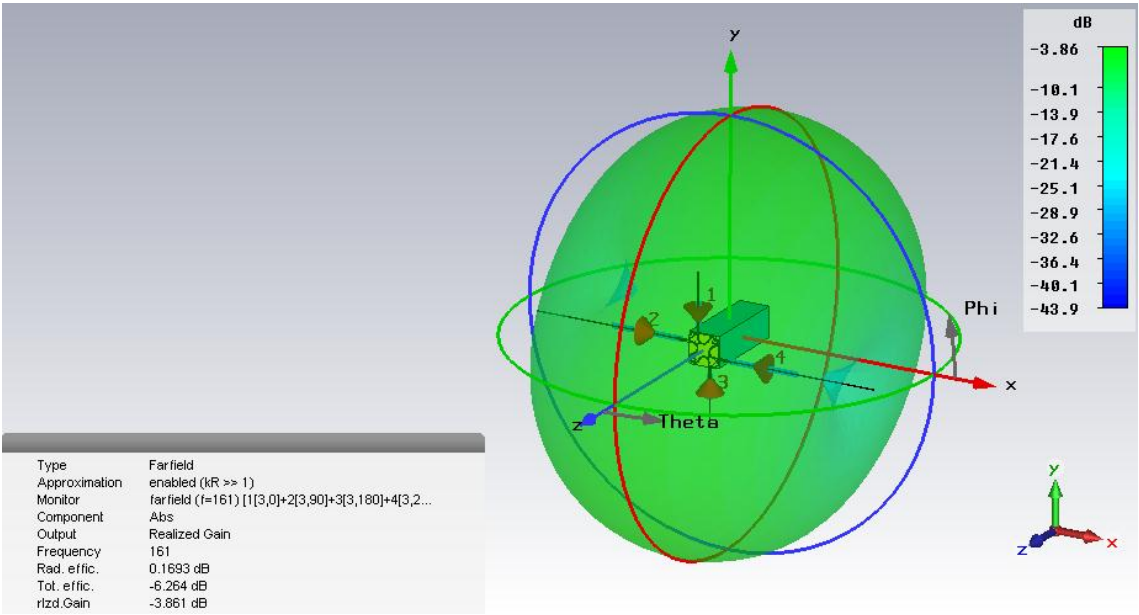


Figure 69. A2-Turnstile. 3D Realized Gain Pattern (161 MHz).

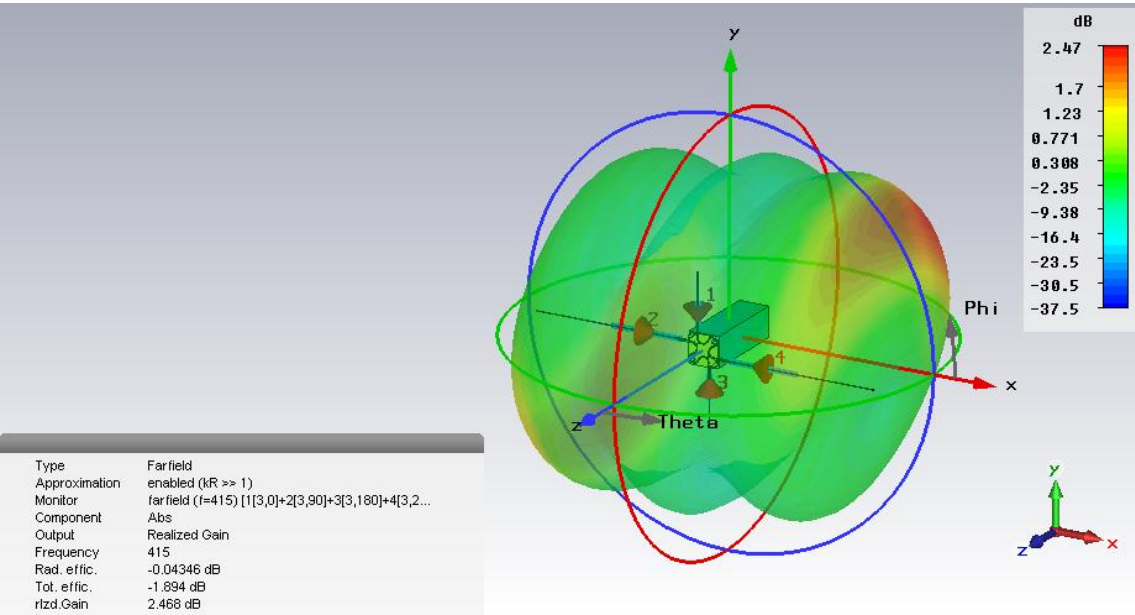


Figure 70. A2-Turnstile. 3D Realized Gain Pattern (415 MHz).

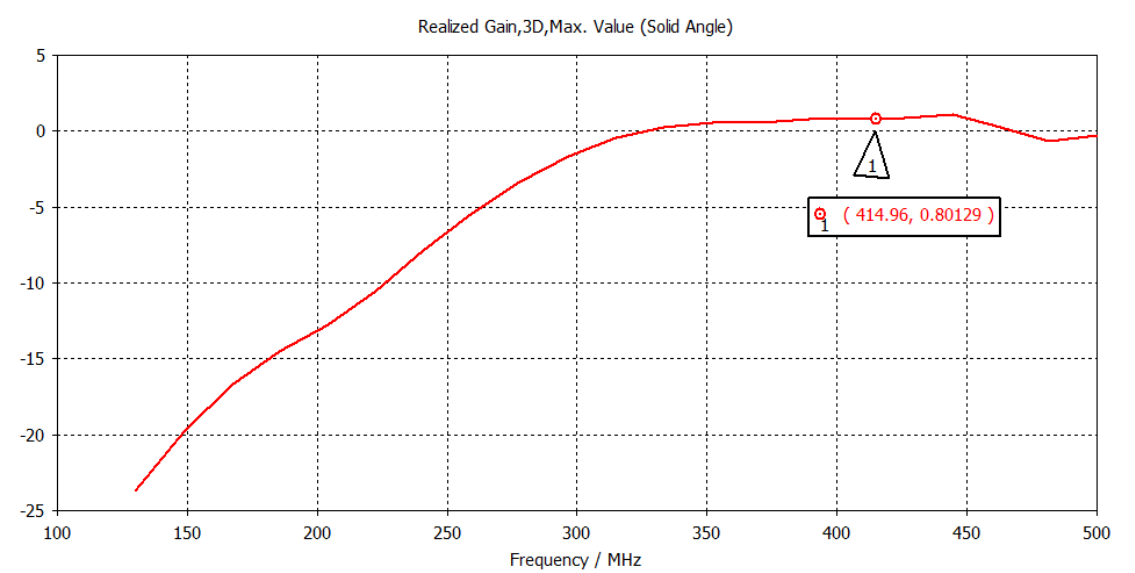


Figure 71. A2-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P1 and P3.

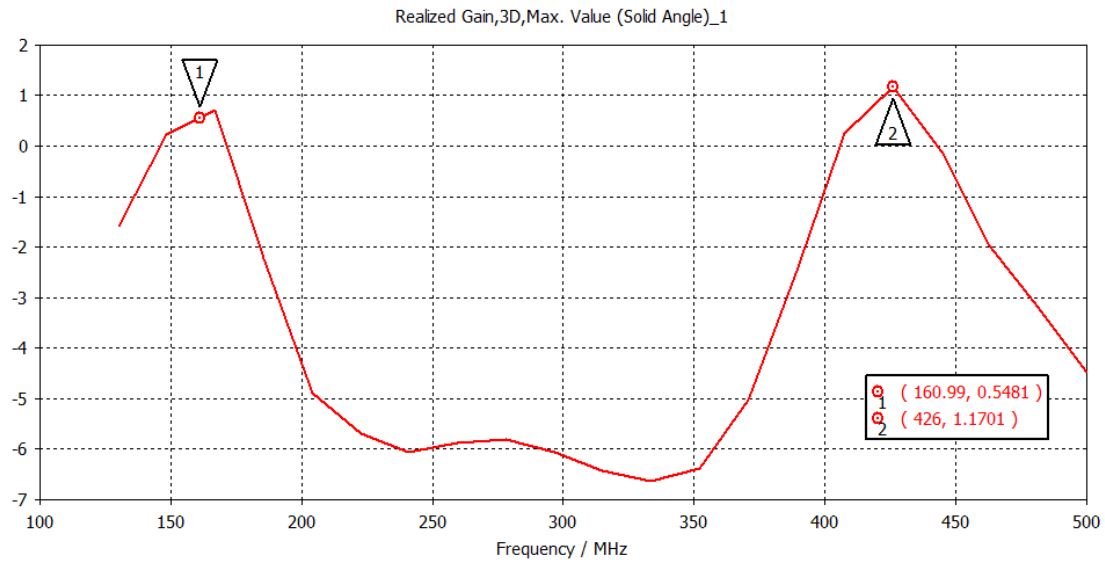


Figure 72. A2-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P2 and P4.

A.2.4.3 Efficiency

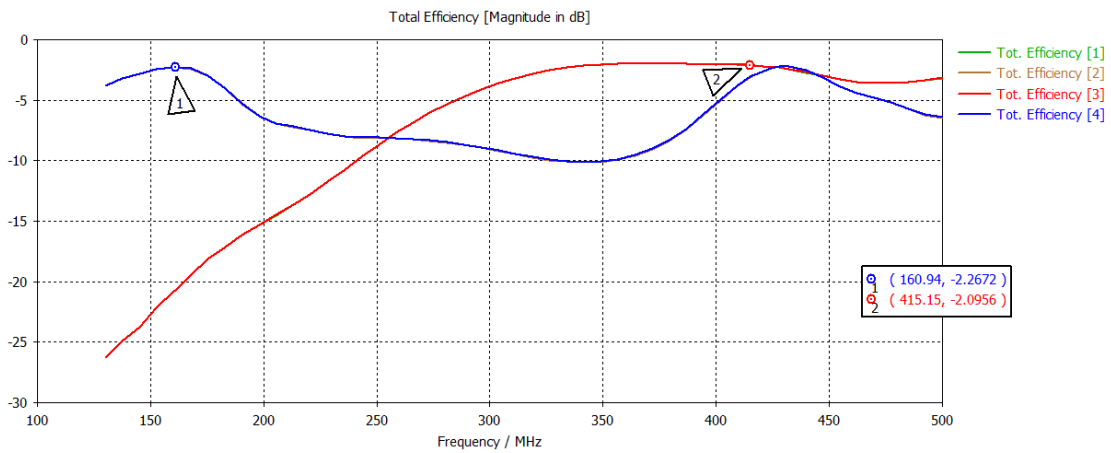


Figure 73. A2-Turnstile. Antenna efficiency dependent on range frequency 130-500 MHz.

A.2.4.4 Electric field

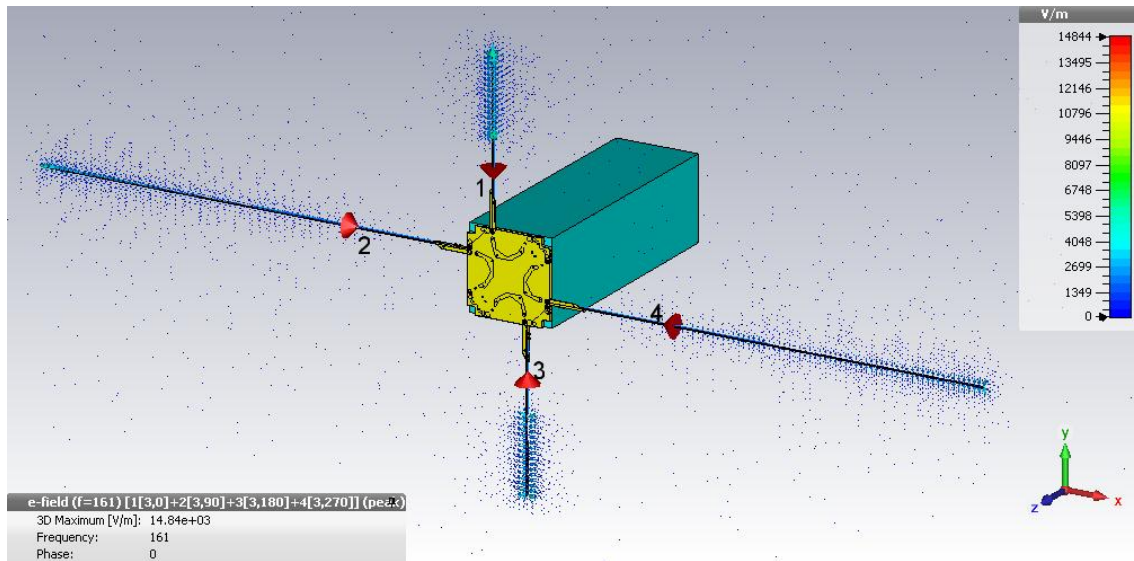


Figure 74. A2-Turnstile. Electric field (161 MHz).

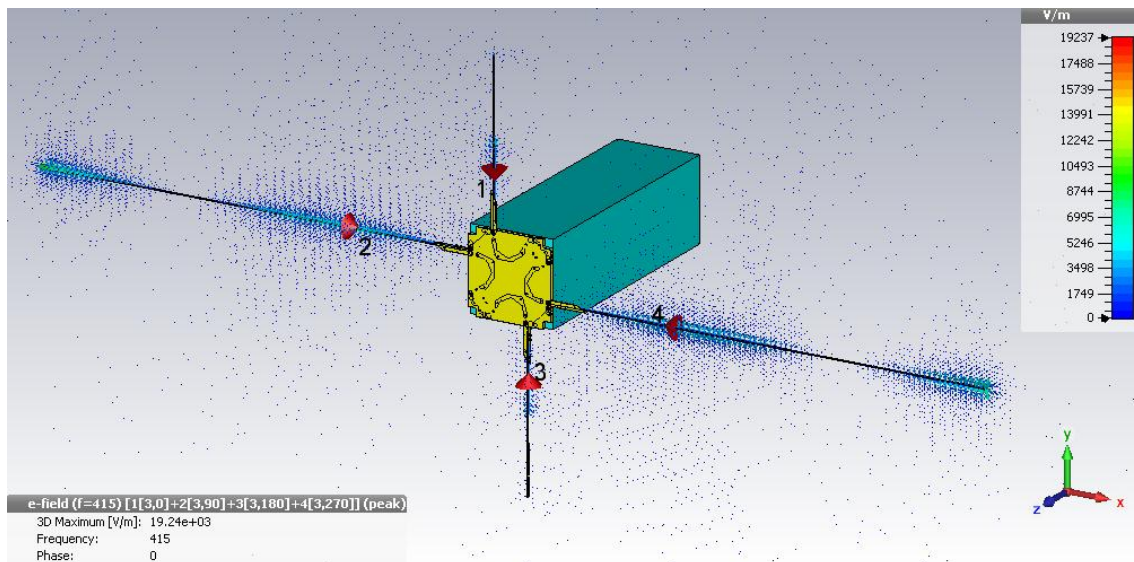


Figure 75. A2-Turnstile. Electric field (415 MHz).

A.2.4.5 Magnetic field

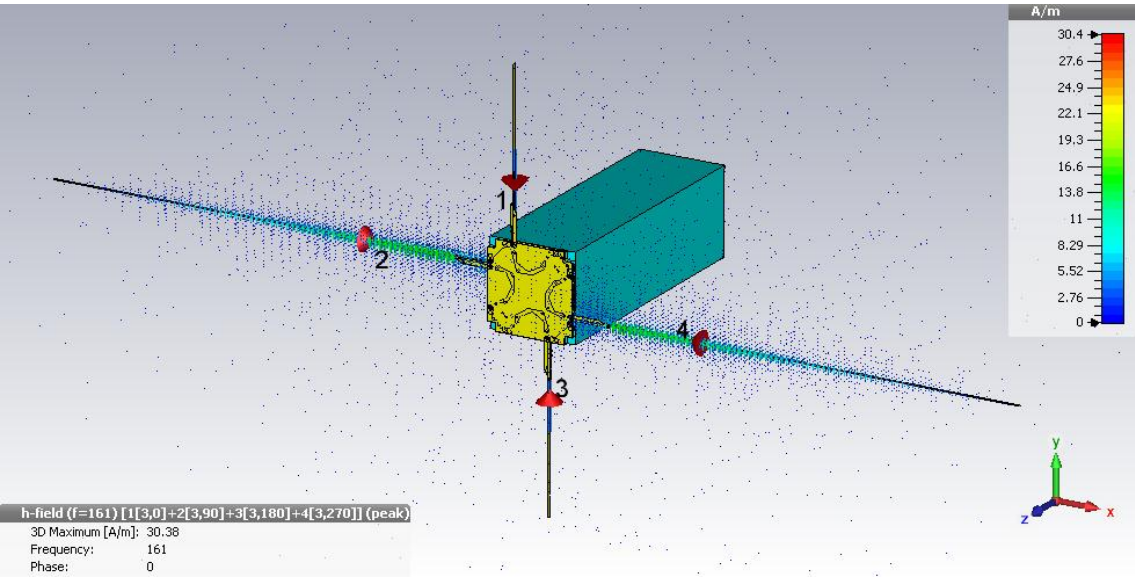


Figure 76. A2-Turnstile. Magnetic field (161 MHz).

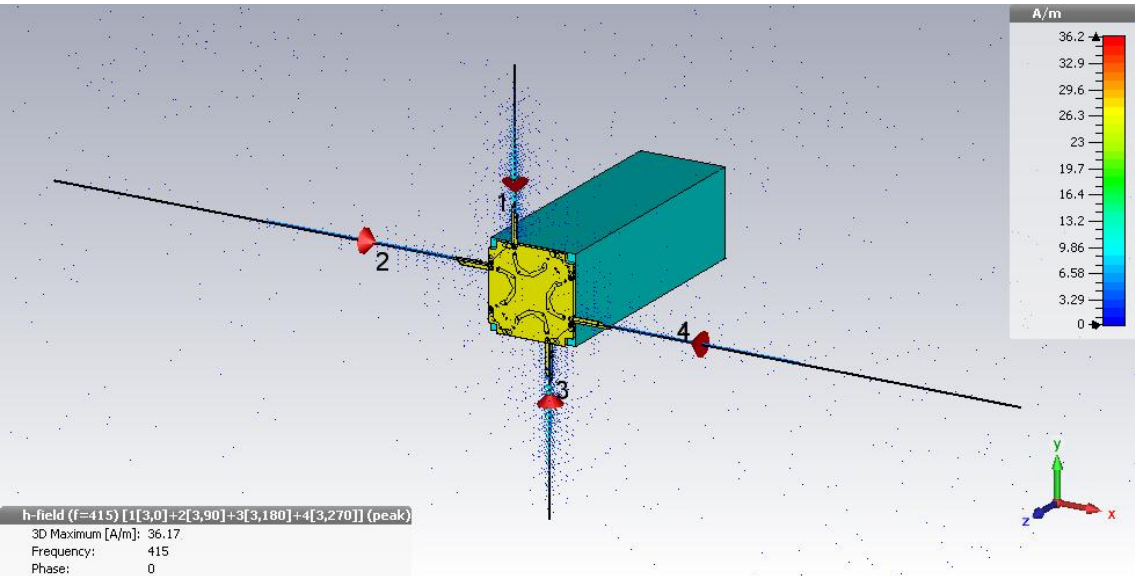


Figure 77. A2-Turnstile. Magnetic field (415 MHz).

A.3 ISARA UHF antenna

A.3.1 Monopole P1

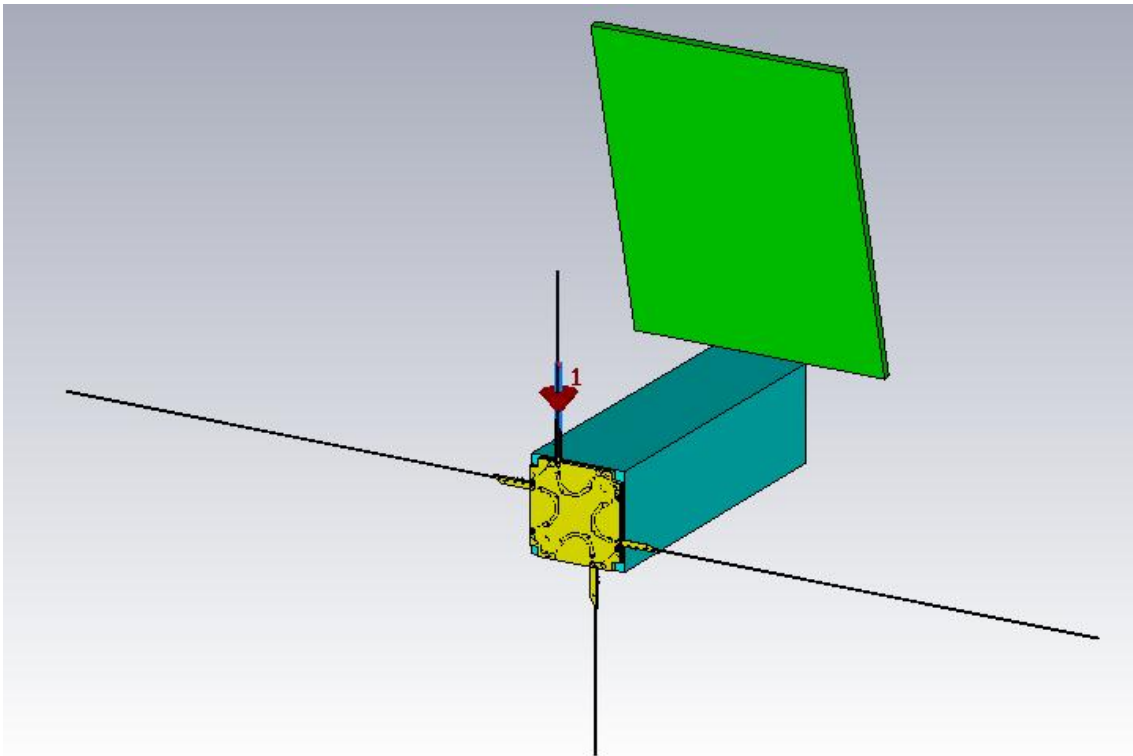


Figure 78. A3-P1. ISARA UHF antenna CAD model.

A.3.1.1 Scattering Parameters (S – Parameters)

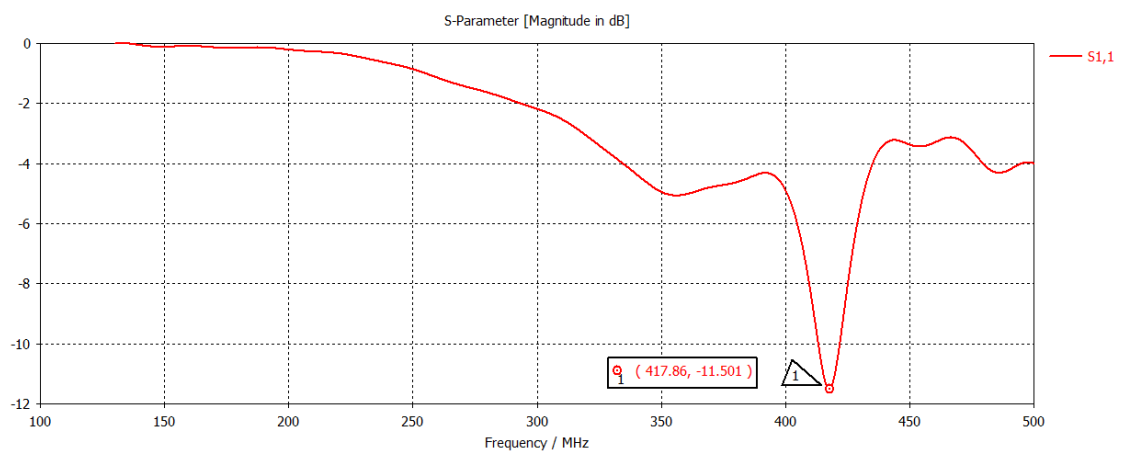


Figure 79. A3-P1.Return loss.

A.3.1.2 Radiation Pattern

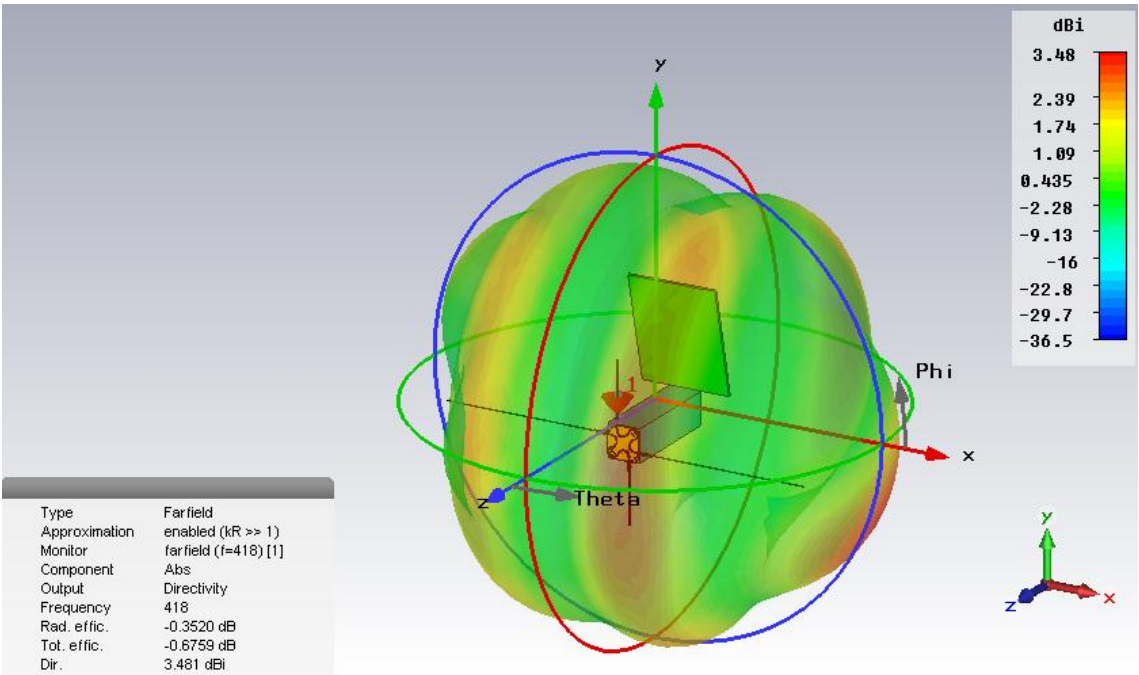


Figure 80. A3-P1. 3D Directivity Pattern (418 MHz).

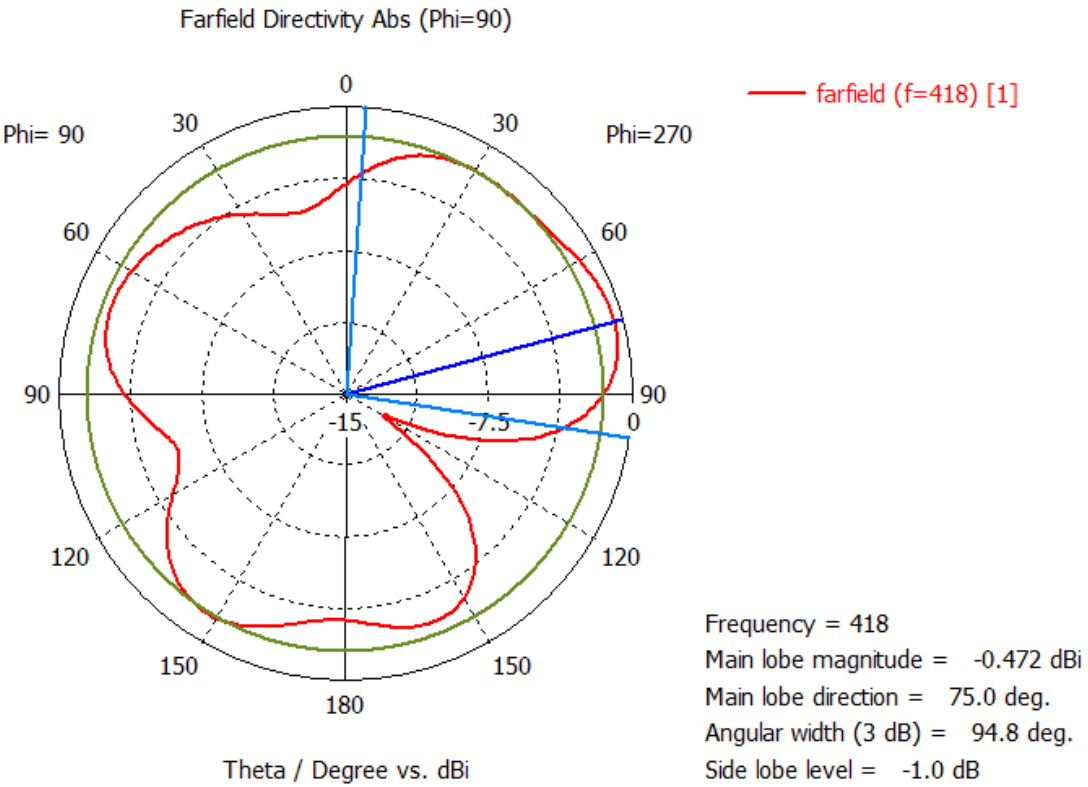


Figure 81. A3-P1. Directivity Polar Diagram (418 MHz).

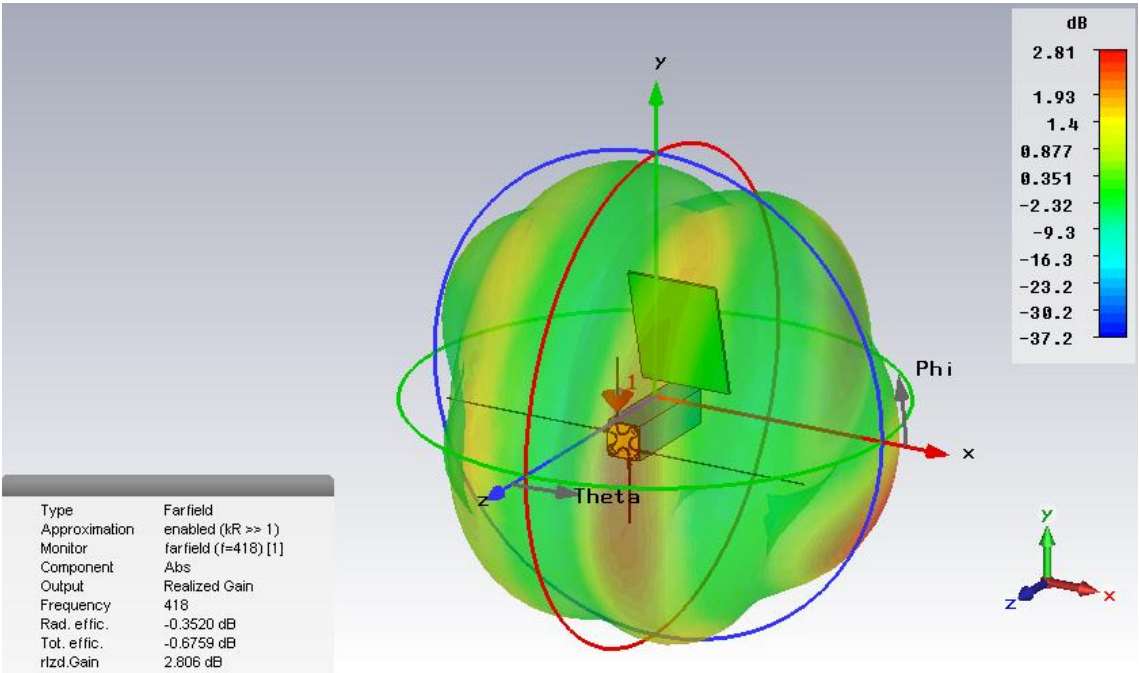


Figure 82. A3-P1. 3D Realized Gain Pattern (418 MHz).

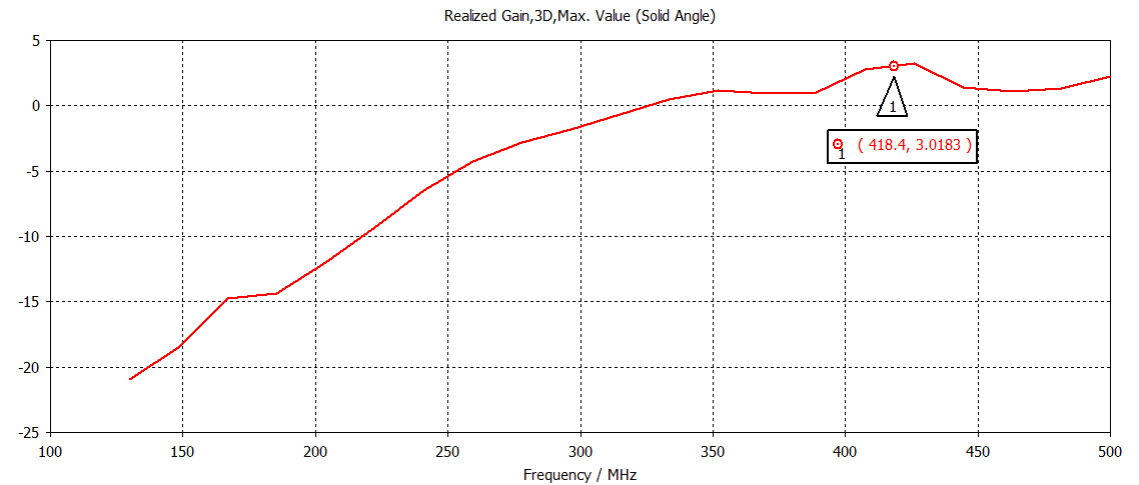


Figure 83. A3-P1.Realized Gain dependent on range frequency 130-500 MHz.

A.3.1.3 Efficiency

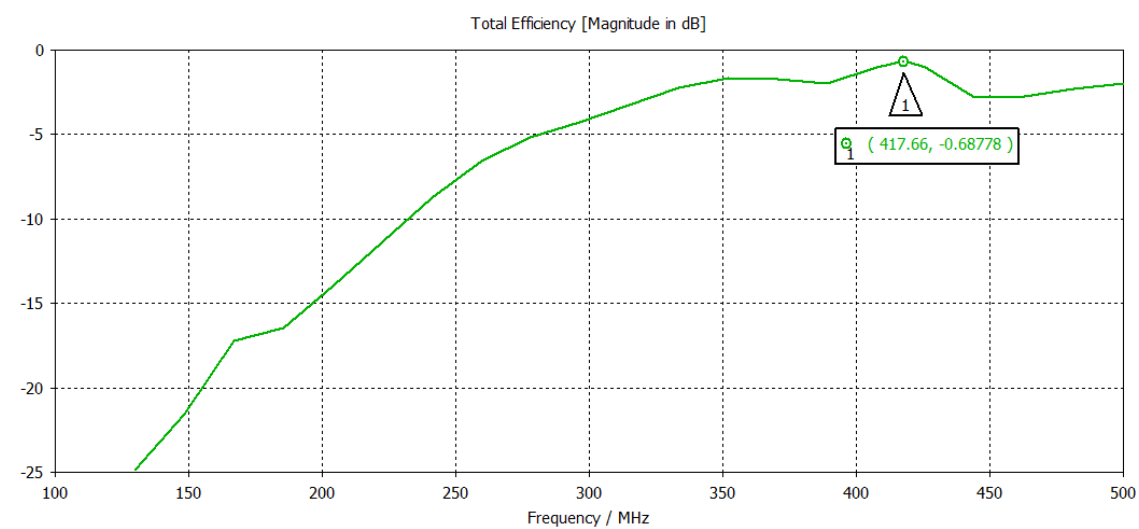


Figure 84. A3-P1. Antenna efficiency dependent on range frequency 130-500 MHz.

A.3.1.4 Electric field

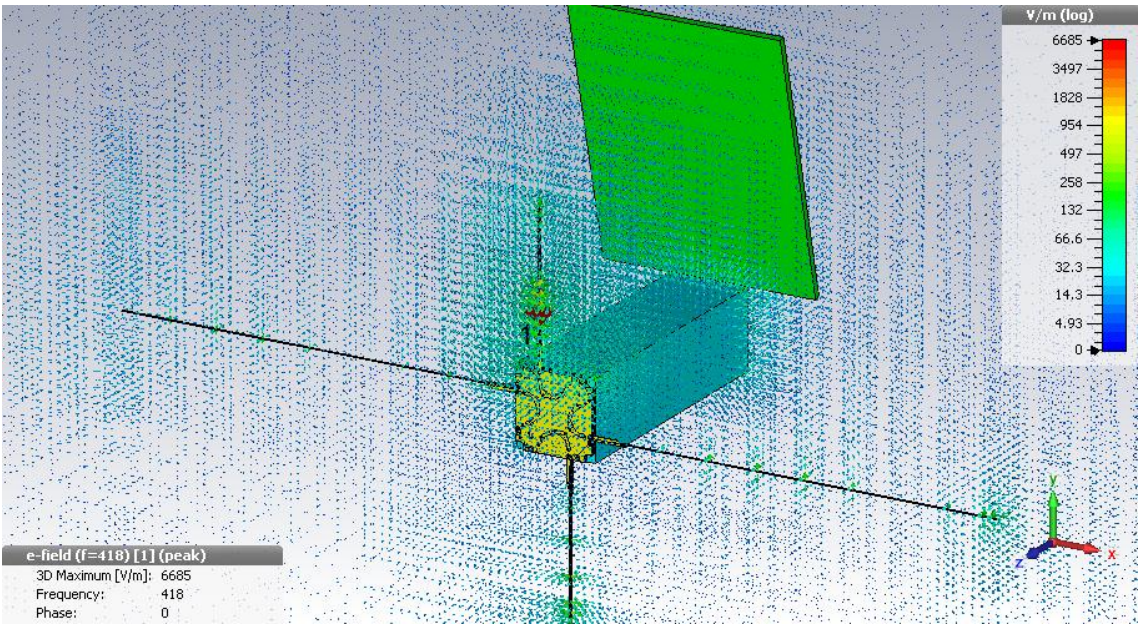


Figure 85. A3-P1. Electric field (418 MHz).

A.3.1.5 Magnetic field

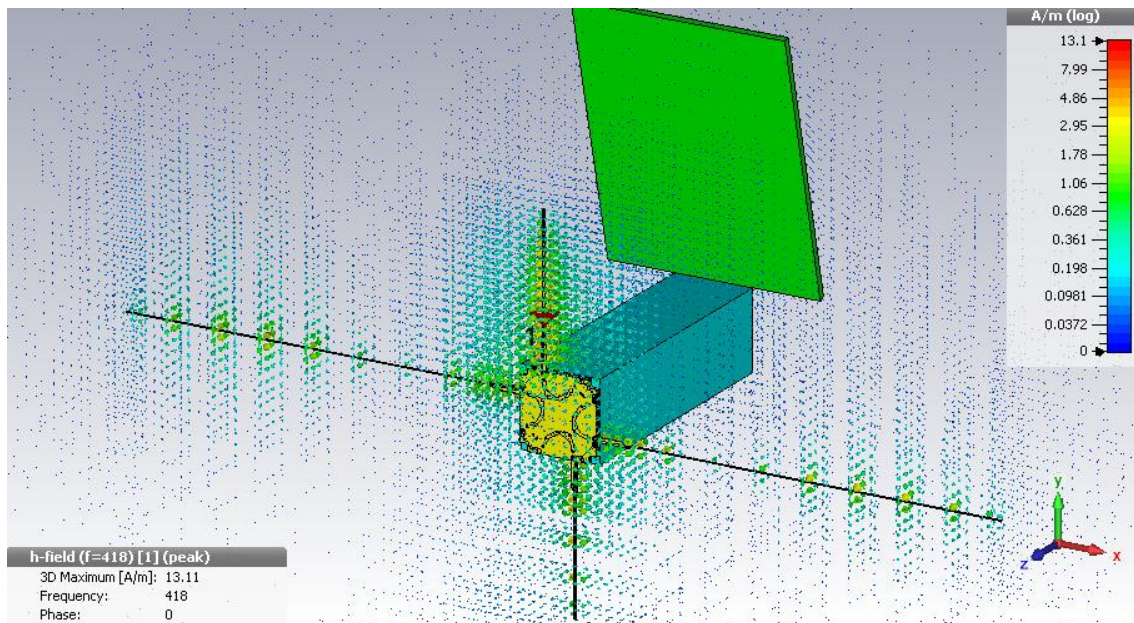


Figure 86. A3-P1. Magnetic field (418 MHz).

A.3.2 Monopole P2

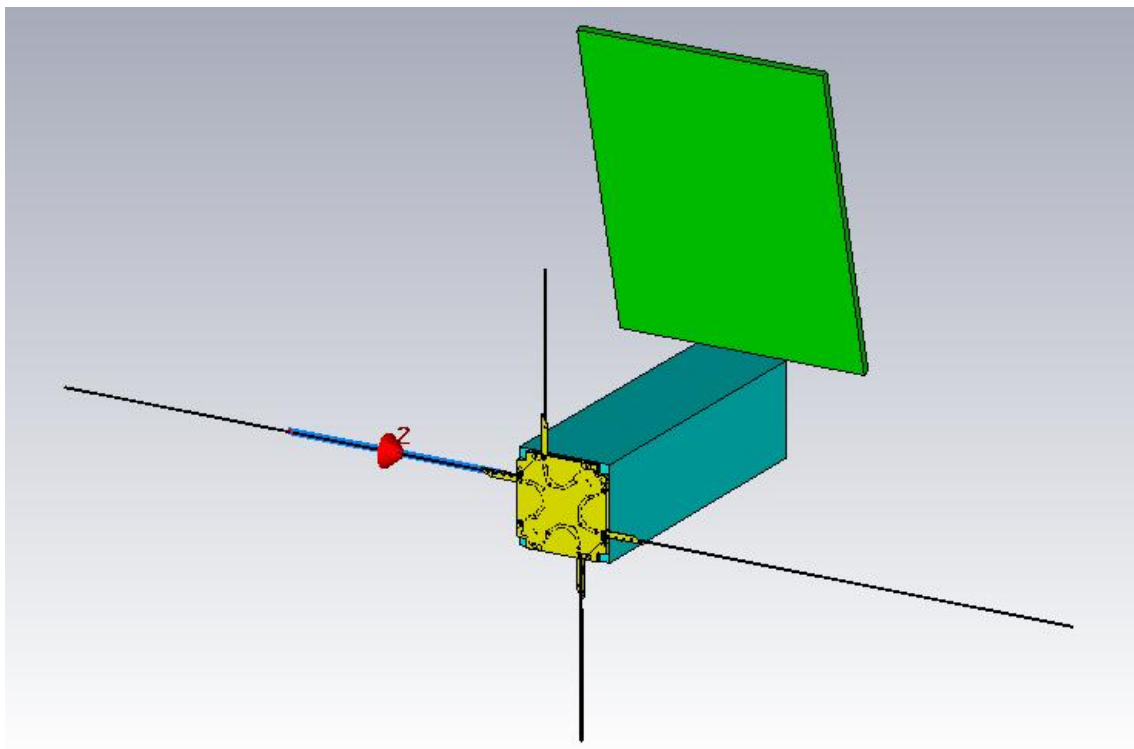


Figure 87. A3-P2. ISARA UHF antenna CAD model.

A.3.2.1 Scattering Parameters (S – Parameters)

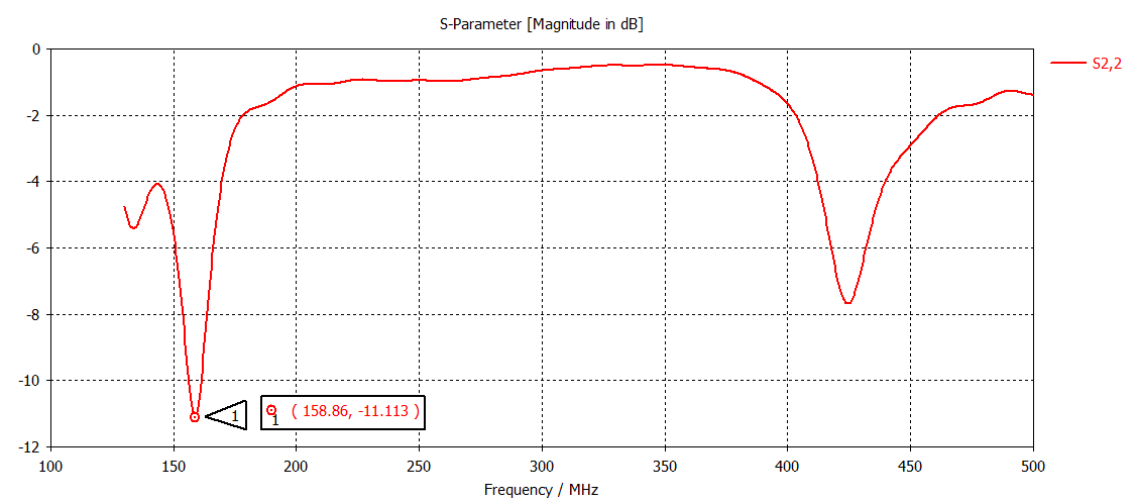


Figure 88. A3-P2. Return loss.

A.3.2.2 Radiation Pattern

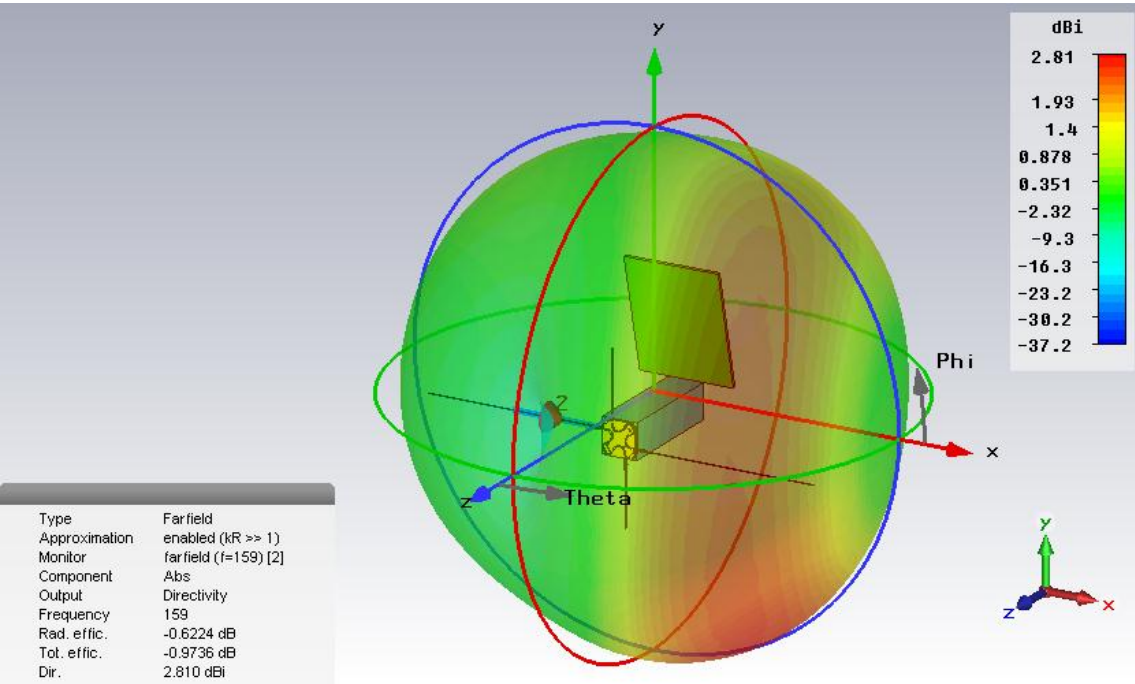


Figure 89. A3-P2. 3D Directivity Pattern (159 MHz).

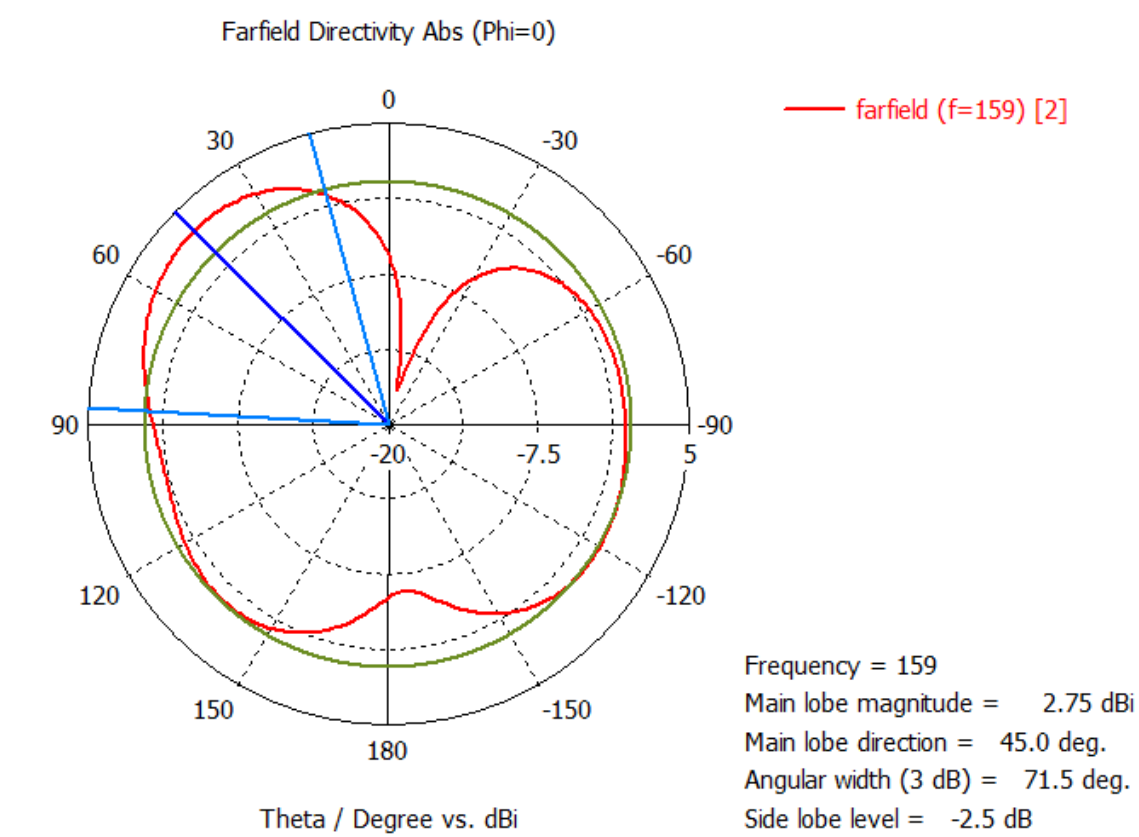


Figure 90. A3-P2. Directivity Polar Diagram (159 MHz).

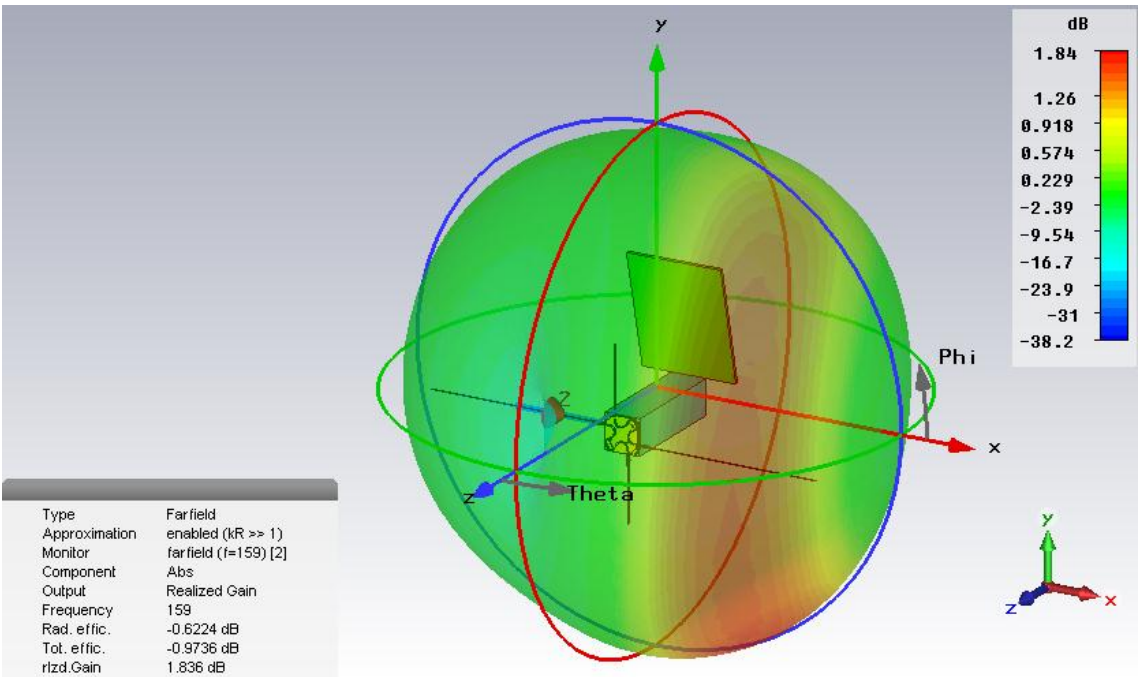


Figure 91. A3-P2. 3D Realized Gain Pattern (159 MHz).

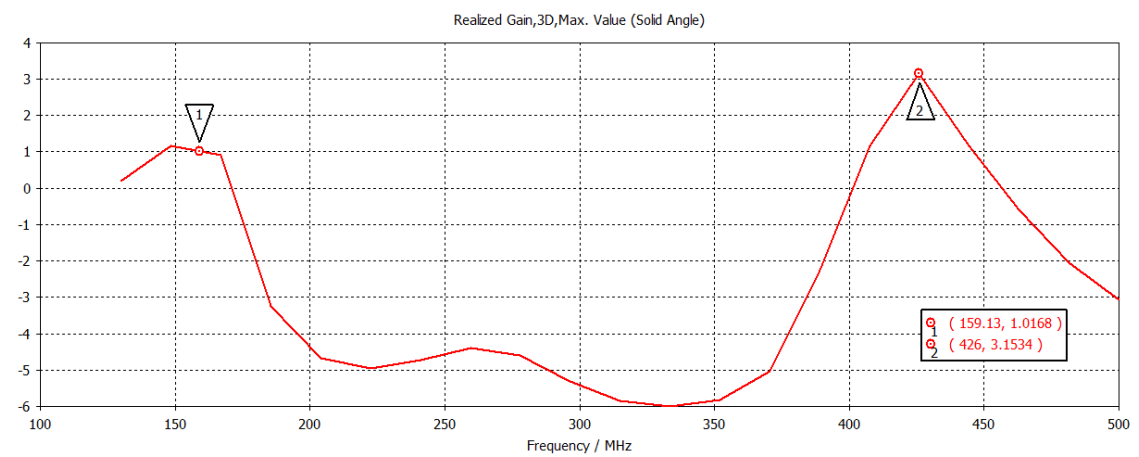


Figure 92. A3-P2. Realized Gain dependent on range frequency 130-500 MHz.

A.3.2.3 Efficiency

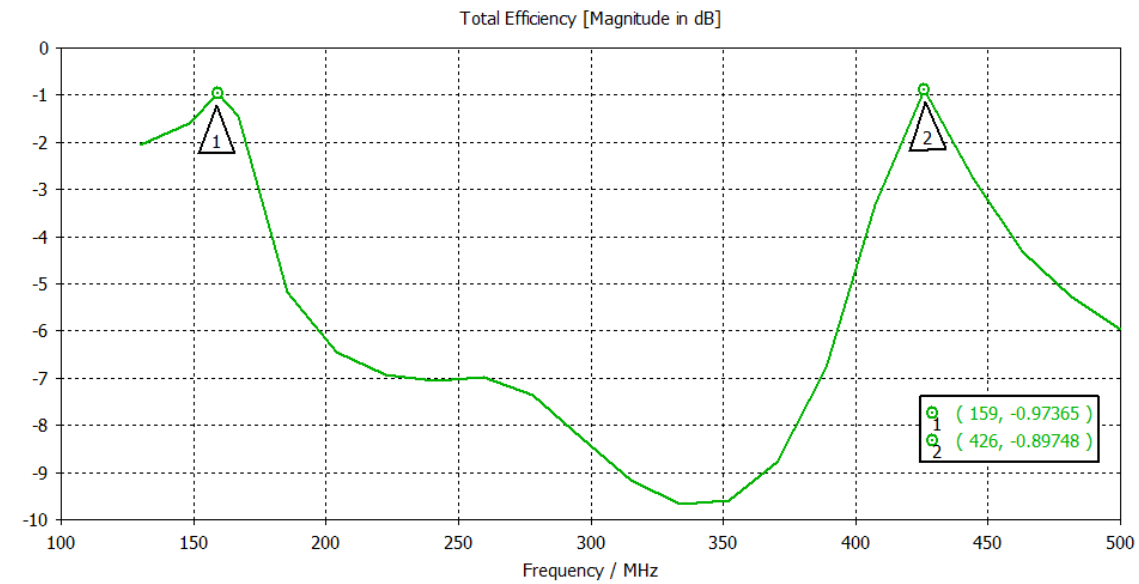


Figure 93. A3-P2. Antenna efficiency dependent on range frequency 130-500 MHz.

A.3.2.4 Electric field

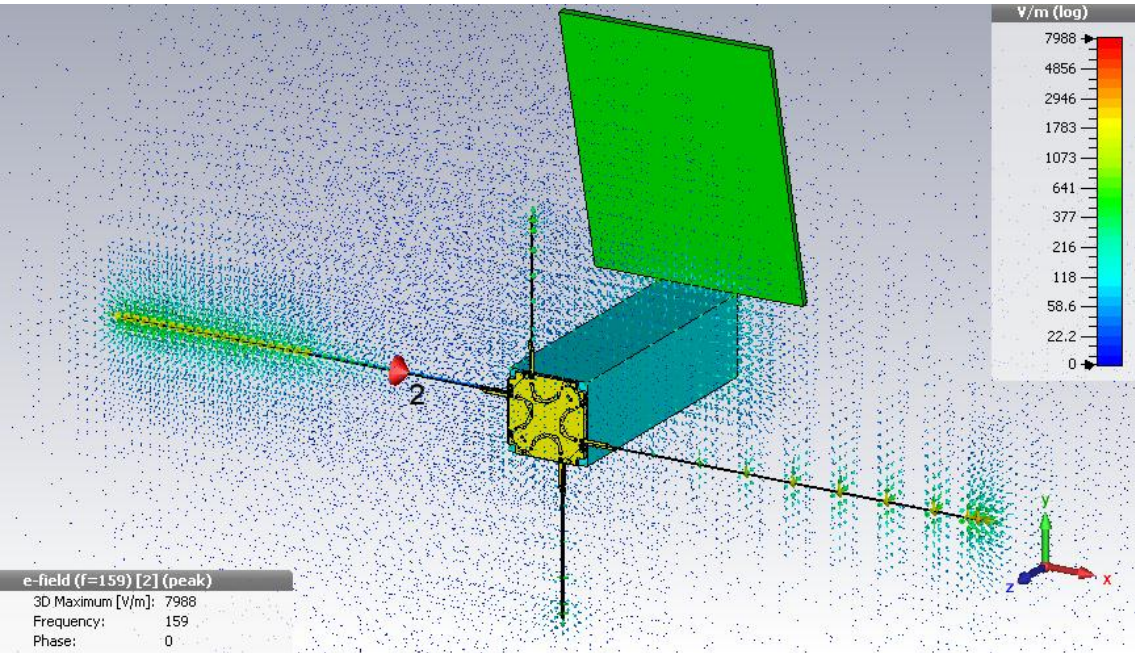


Figure 94. A3-P2. Electric field (159 MHz).

A.3.2.5 Magnetic field

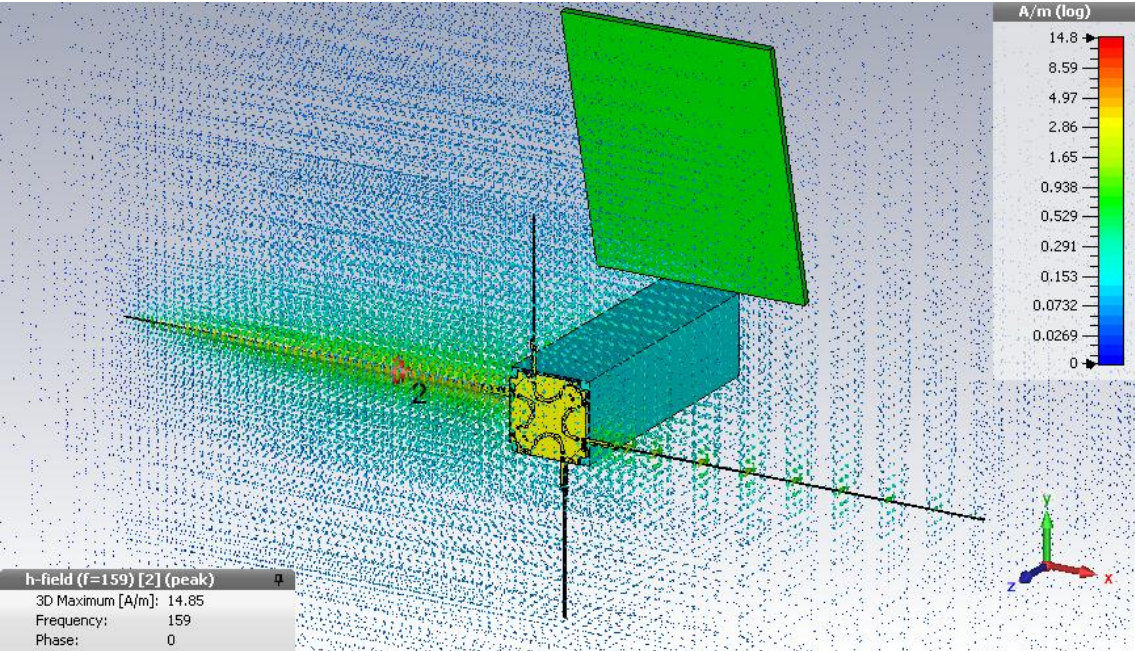


Figure 95. A3-P2. Magnetic field (159 MHz).

A.3.3 Turnstile: All Ports

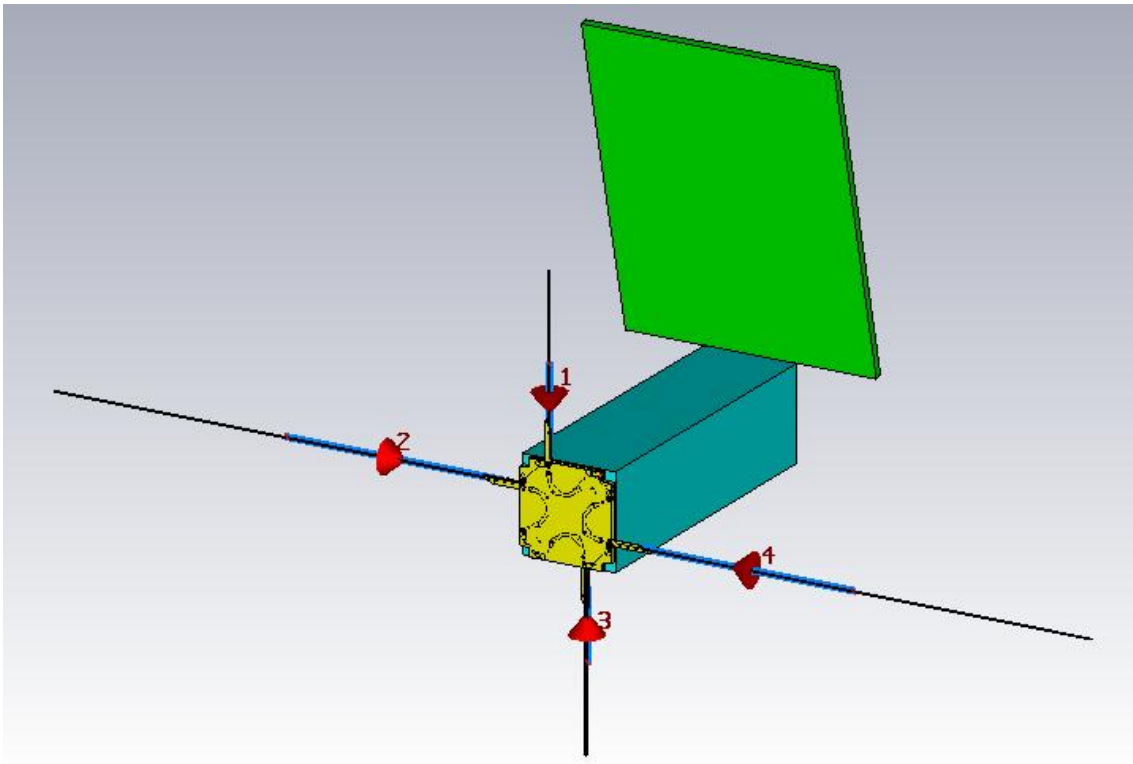


Figure 96. A3-Turnstile. ISARA UHF antenna CAD model.

A.3.3.1 Scattering Parameters (S – Parameters)

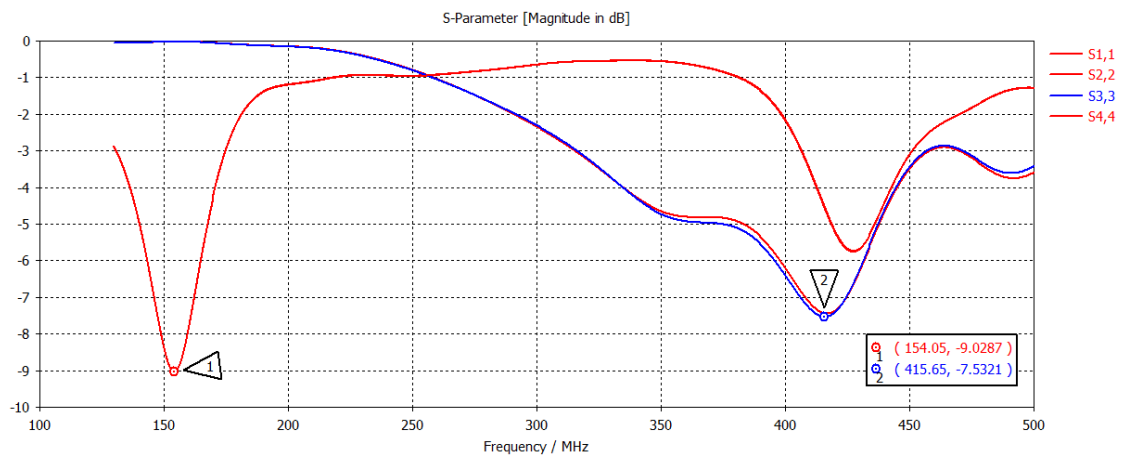


Figure 97. A3-Turnstile. Return loss.

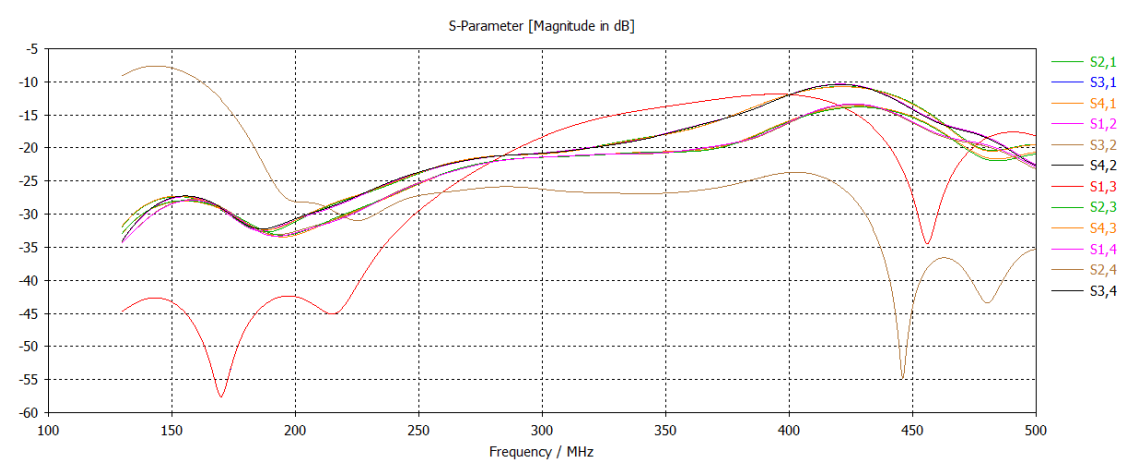


Figure 98. A3-Turnstile. Insertion loss.

A.3.3.2 Radiation Pattern

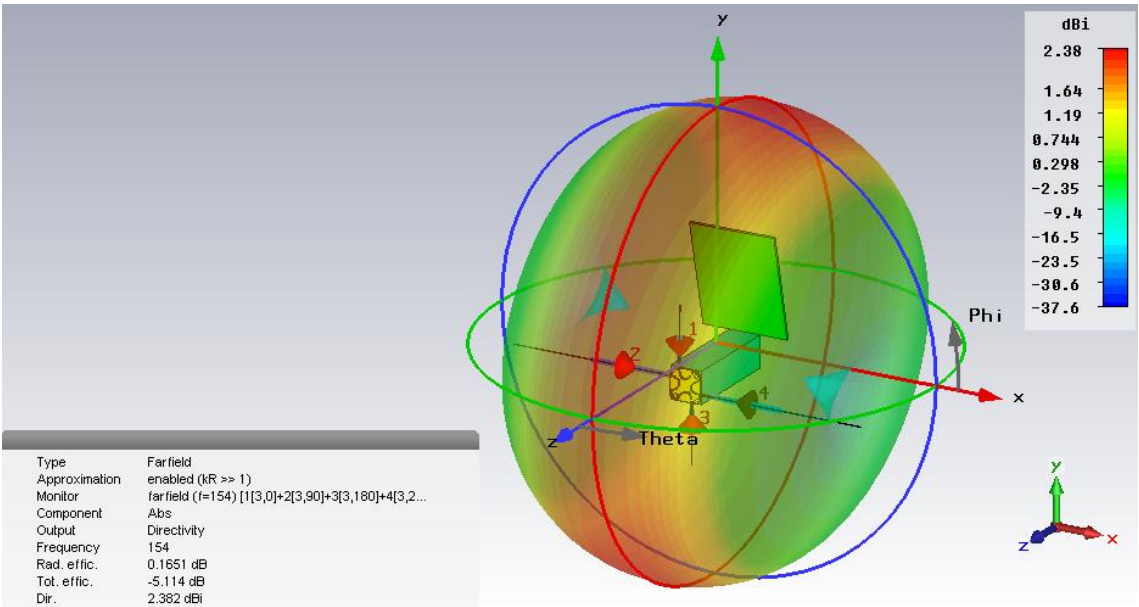


Figure 99. A3-Turnstile. 3D Directivity Radiation Pattern (154 MHz).

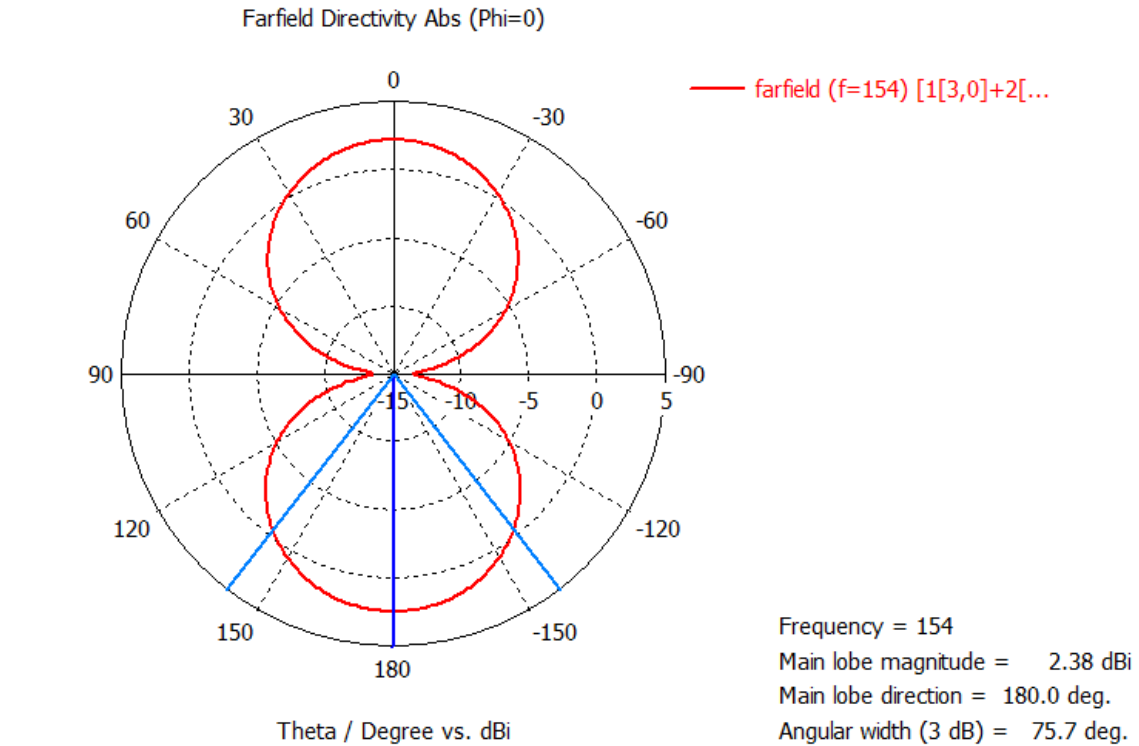


Figure 100. A3-Turnstile. Directivity Polar Diagram (154 MHz).

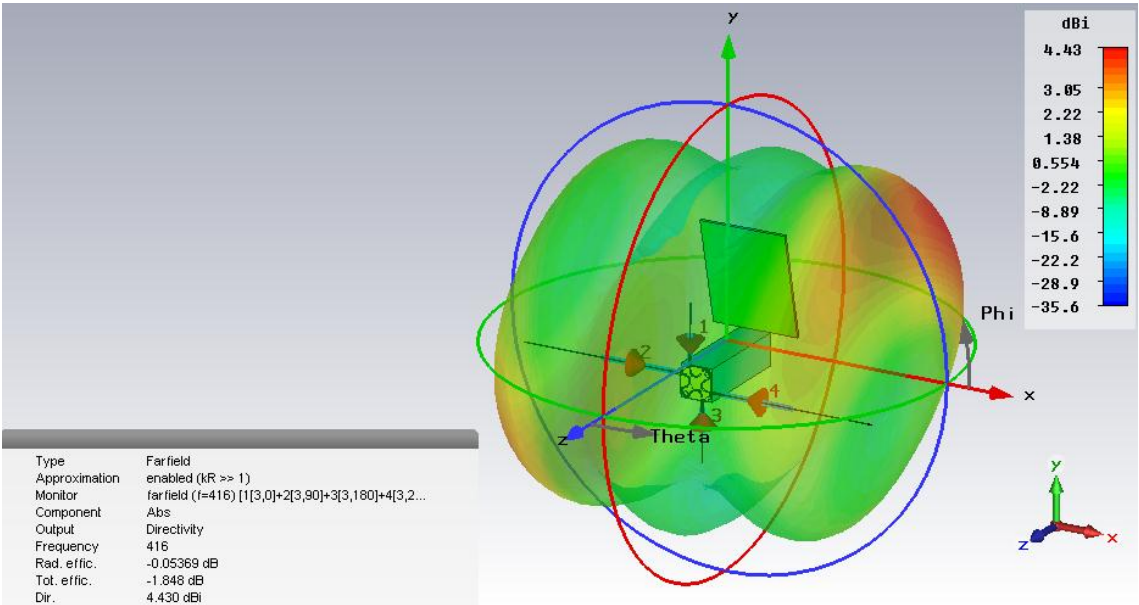


Figure 101. A3-Turnstile. 3D Directivity Pattern (416 MHz).

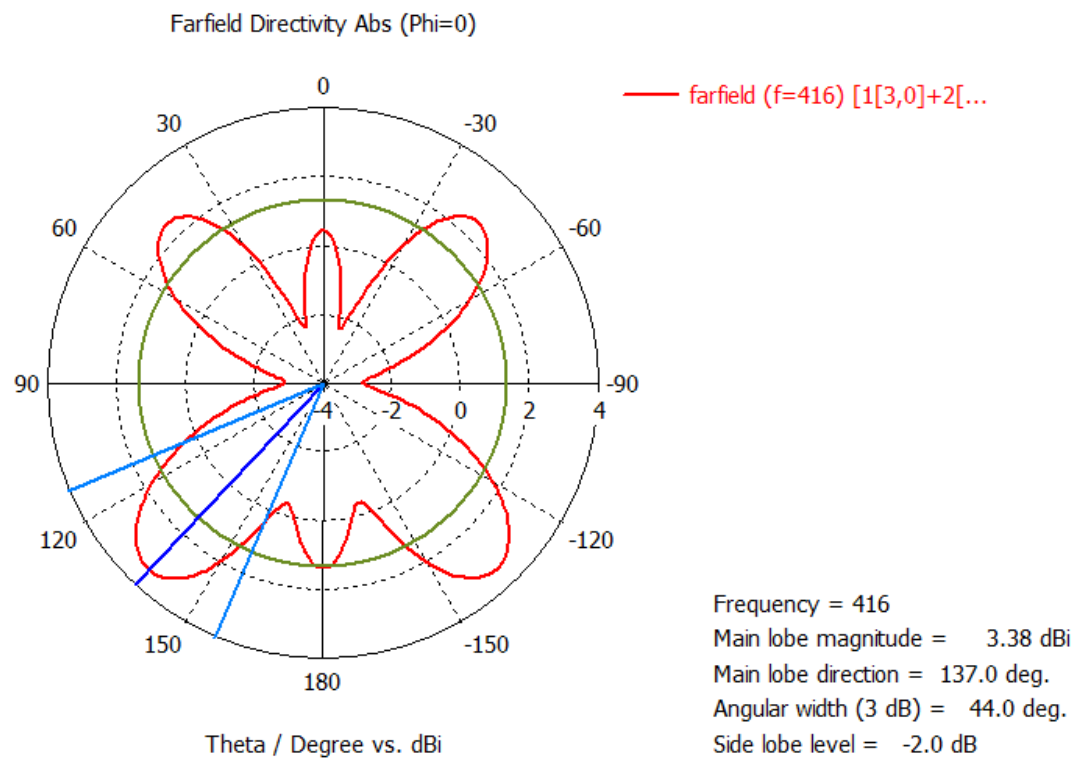


Figure 102. A3-Turnstile. Directivity Polar Diagram (416 MHz).

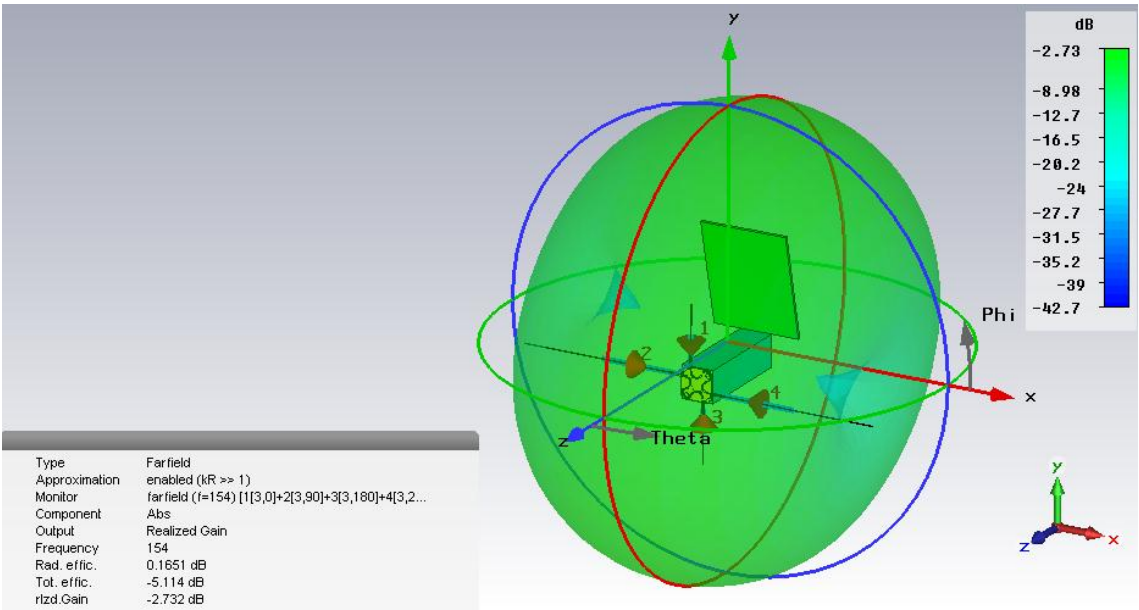


Figure 103. A3-Turnstile. 3D Realized Gain Pattern (154 MHz).

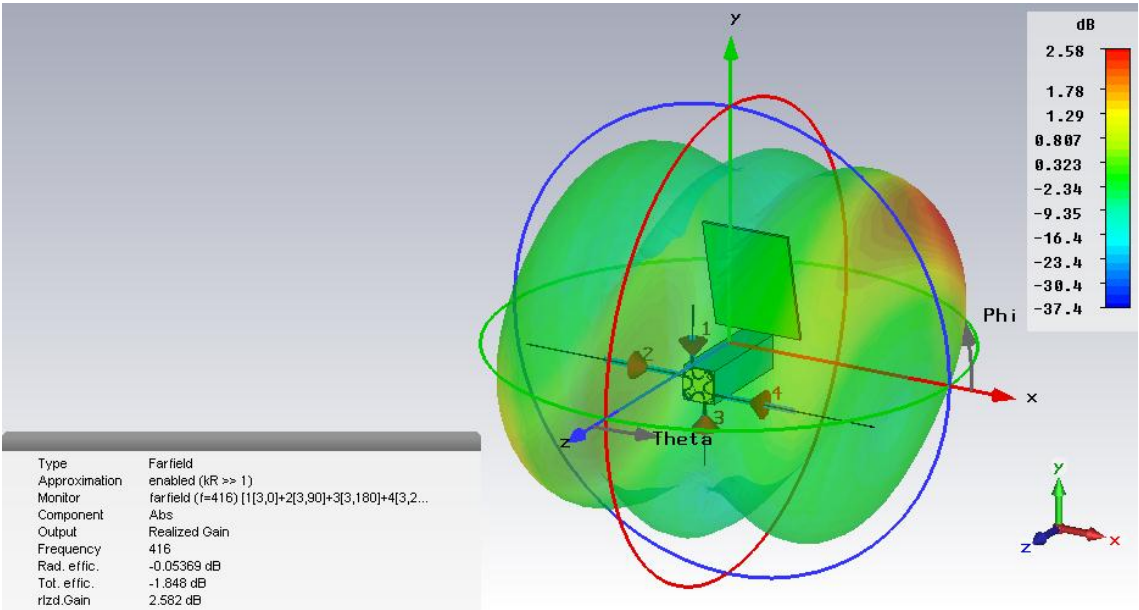


Figure 104. A3-Turnstile. 3D Realized Gain Pattern (416 MHz).

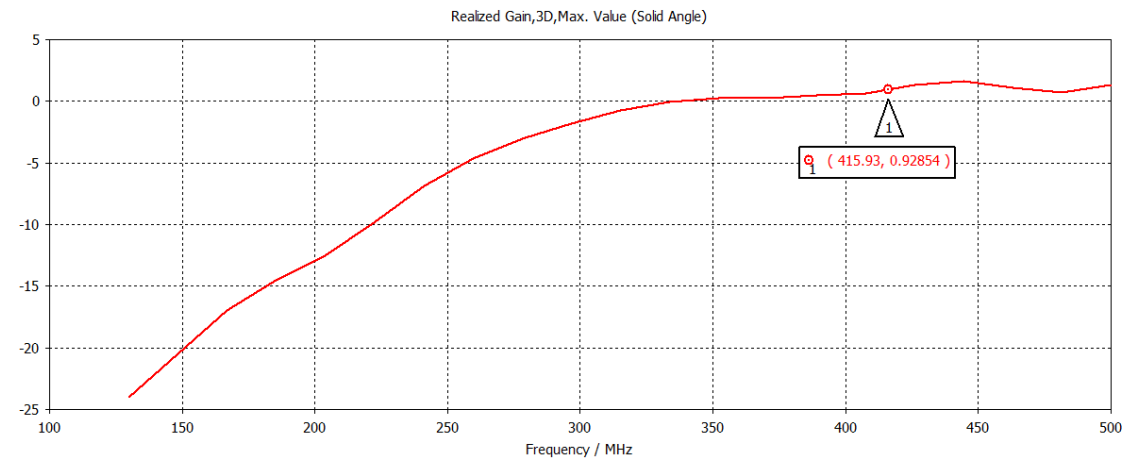


Figure 105. A3-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P1 and P3.

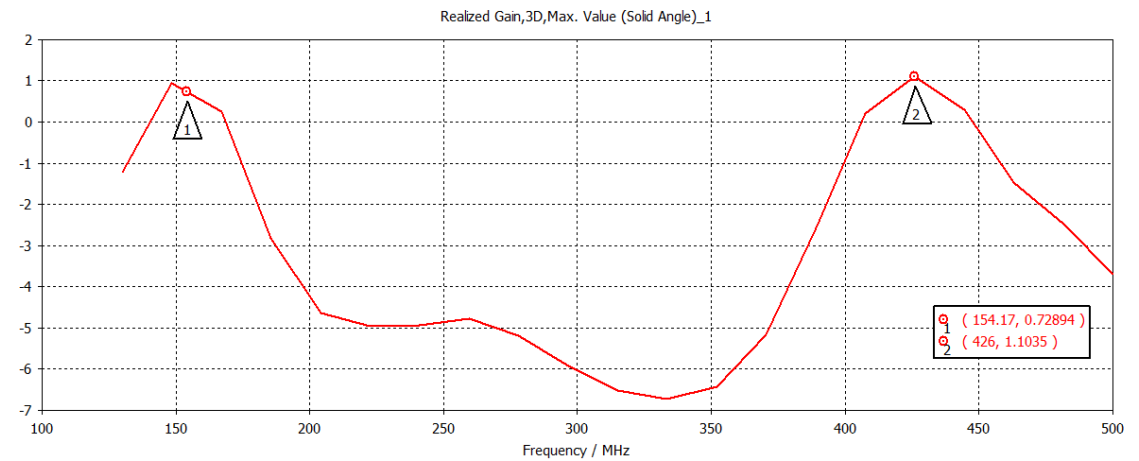


Figure 106. A3-Turnstile. Realized Gain dependent on range frequency 130-500 MHz. P2 and P4.

A.3.3.3 Efficiency

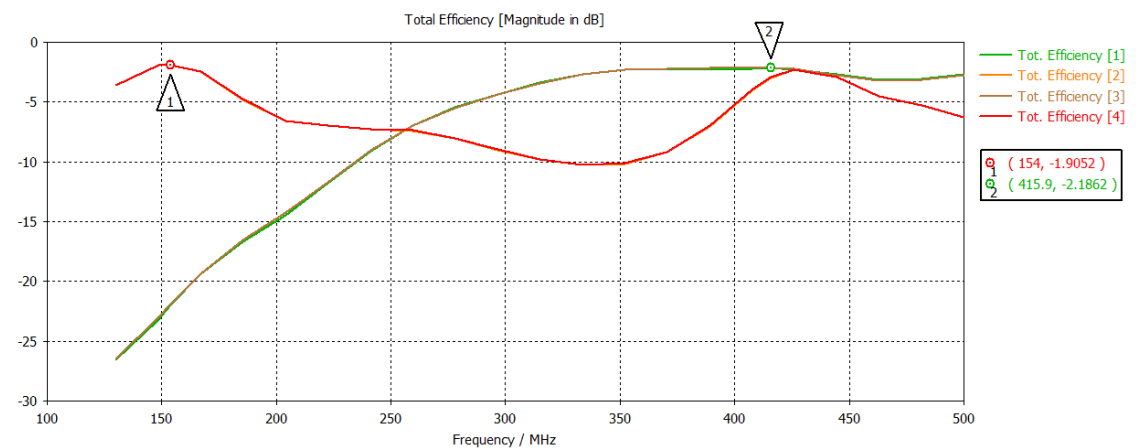


Figure 107. A3-Turnstile. Antenna efficiency dependent on range frequency 130-500 MHz.

A.3.3.4 Electric field

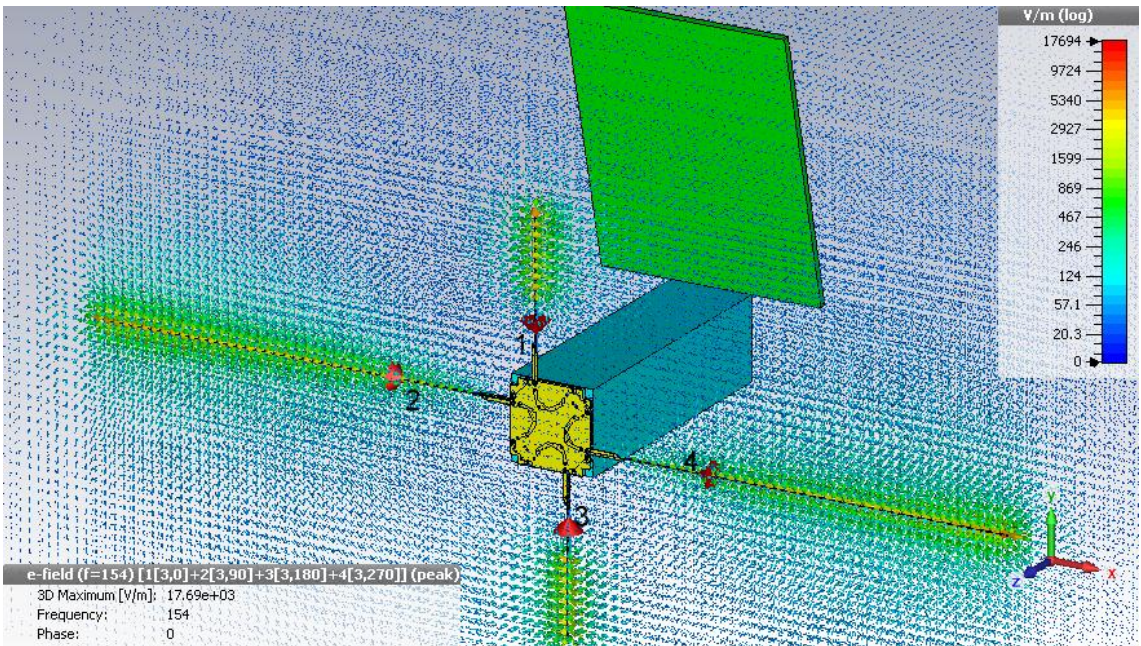


Figure 108. A3-Turnstile. Electric field (154 MHz).

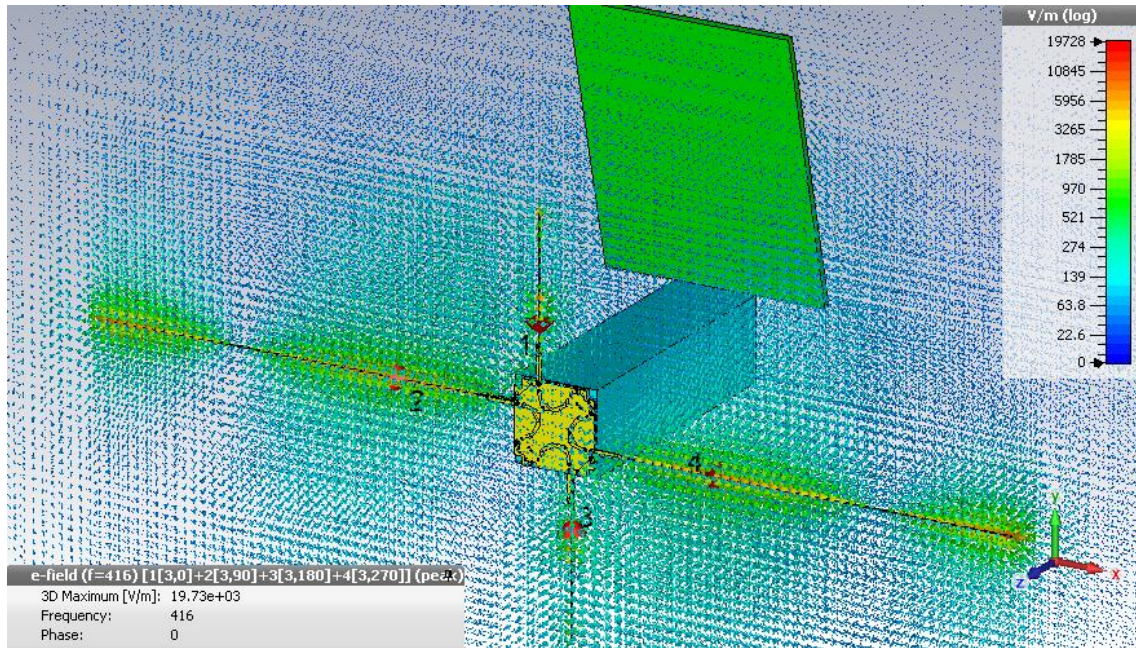


Figure 109. A3-Turnstile. Electric field (416 MHz).

A.3.3.5 Magnetic field

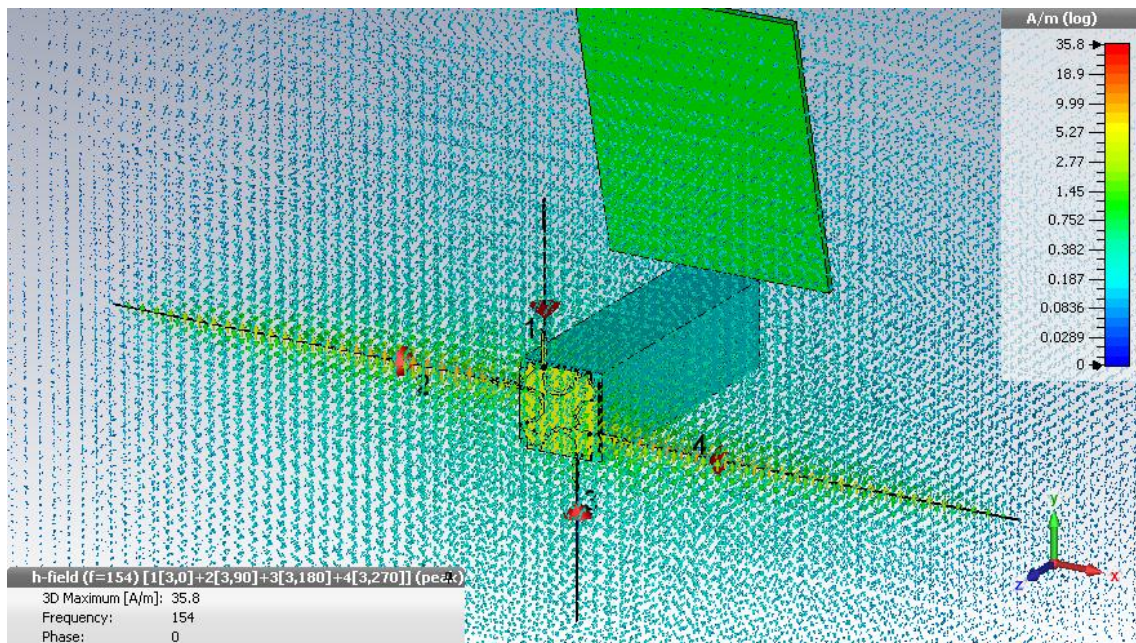


Figure 110. A3-Turnstile. Magnetic field (154 MHz).

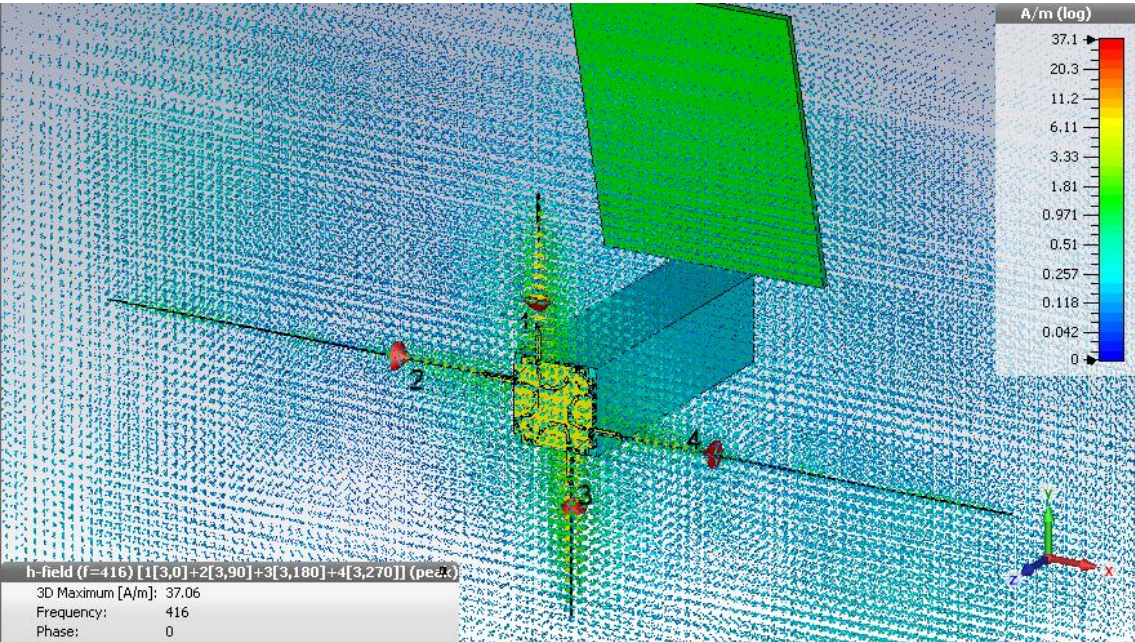


Figure 111. A3-Turnstile. Magnetic field (416 MHz).

B. ISIS WEBSITE RADIATION PATTERNS

B.1 3U UHF Monopole

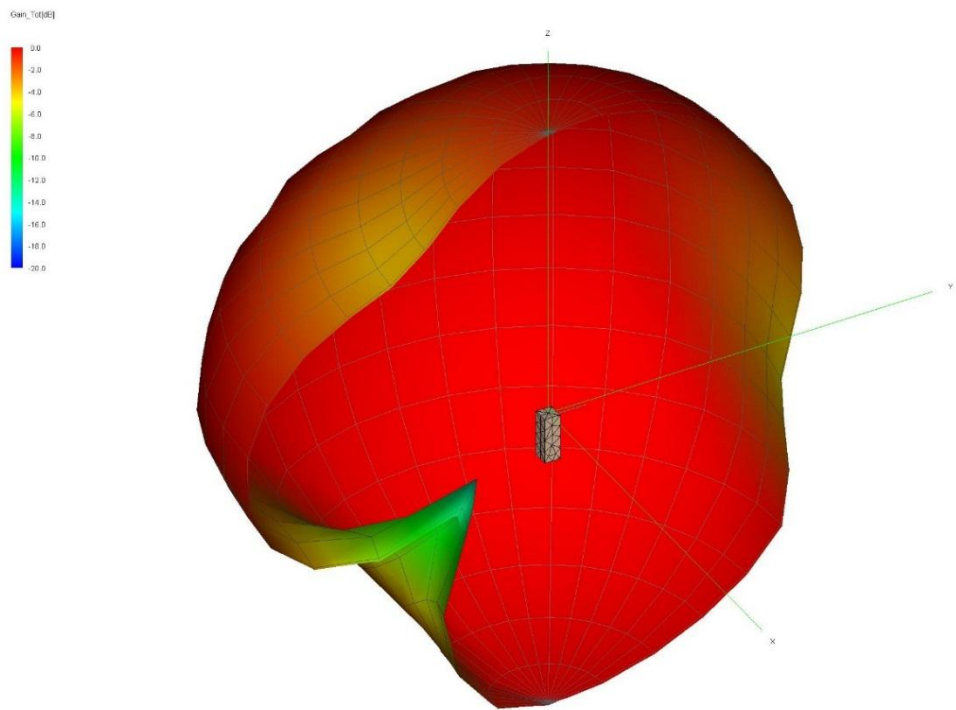


Figure 112. B1. 3D Gain Pattern.

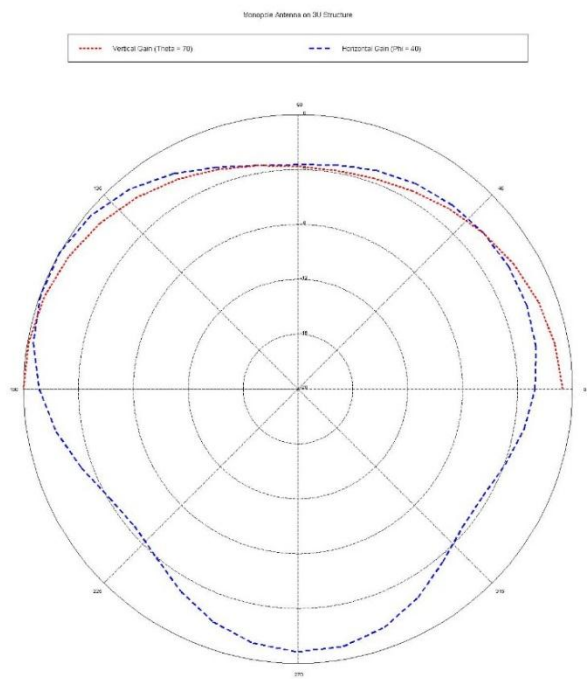


Figure 113. B1. Gain Polar Diagram.

B.2 3U UHF Dipole

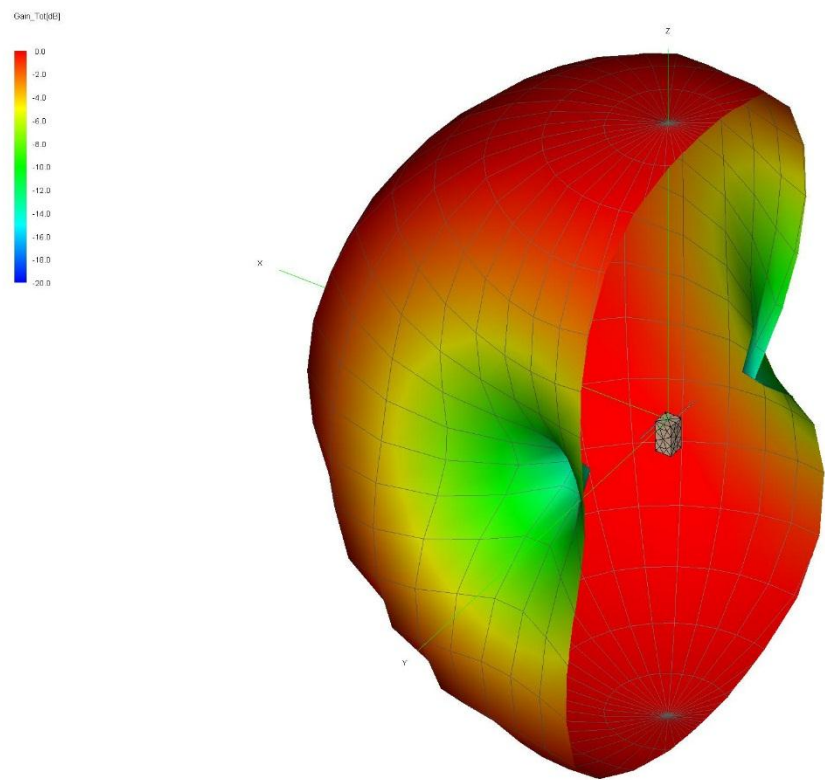


Figure 114. B2. 3D Gain Pattern.

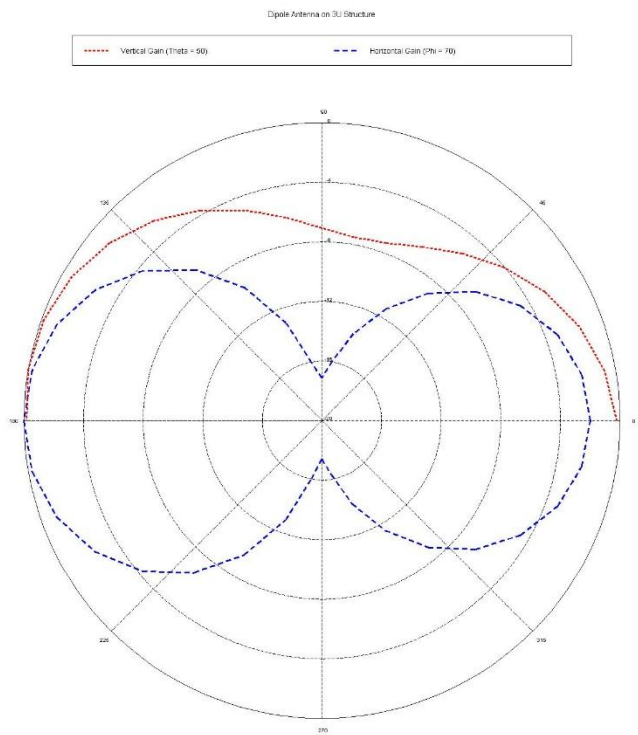


Figure 115. B2. Gain Polar Diagram.

B.3 3U UHF Turnstile

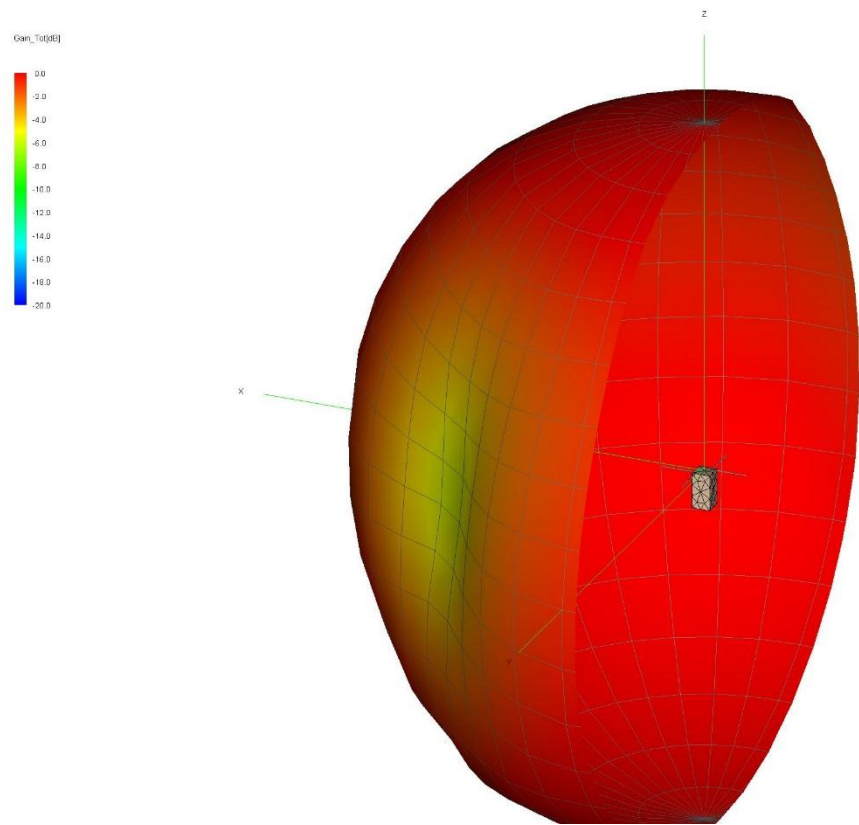


Figure 116. B3. 3D Gain Pattern.

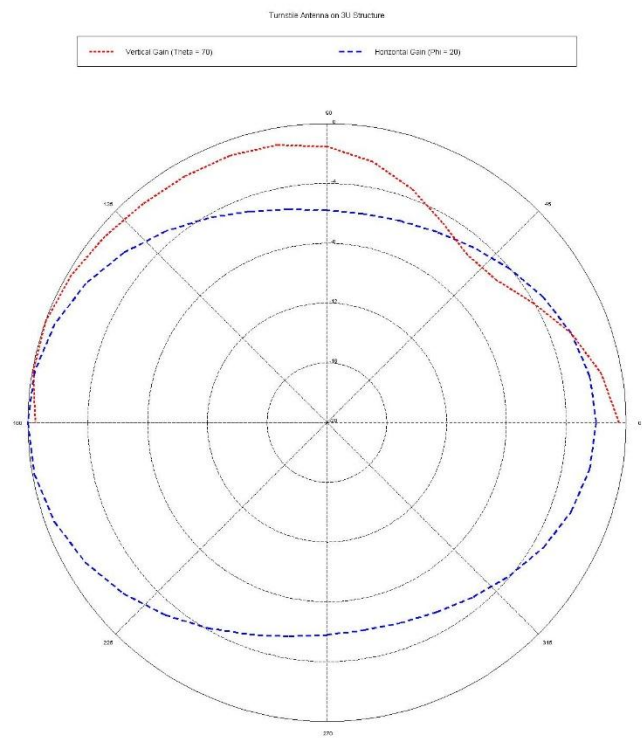


Figure 117. B3. Gain Polar Diagram.

